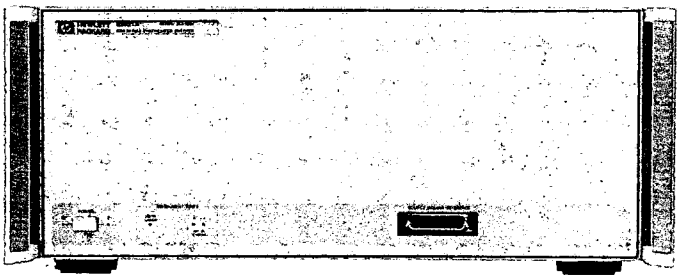
SERVICE MANUAL

HP 8360 SERIES SYNTHESIZED SWEEPERS

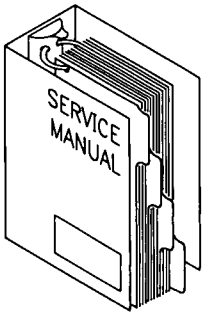
For Use With
HP 8510 Network Analyzers

MODELS
83621A
83631A
83651A



HEWLETT PACKARD

HP 8360 SERIES DOCUMENTATION MAP
SERVICE MANUAL



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PREFACE

HP 83621A/31A/51A Synthesized Sweepers

Service Manual

SERIAL NUMBERS

This manual applies to any HP 83621A/31A synthesized sweeper with serial number prefixes 3103A and 3104A and to any HP 83651A synthesized sweeper with a serial number prefixes 3044A and 3104A. For additional information about serial numbers, see "Instruments Covered by this Manual" in the "Preface".



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Edition 1

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Preface

The HP 83621A/31A/51A Synthesized Sweepers

The HP 83621A/31A/51A synthesized sweepers are high performance, broadband frequency synthesizers that operate from 0.045 to 20 GHz, 26.5 GHz, and 50 GHz respectively. Figure i shows the front view of the HP 83631A synthesizer.

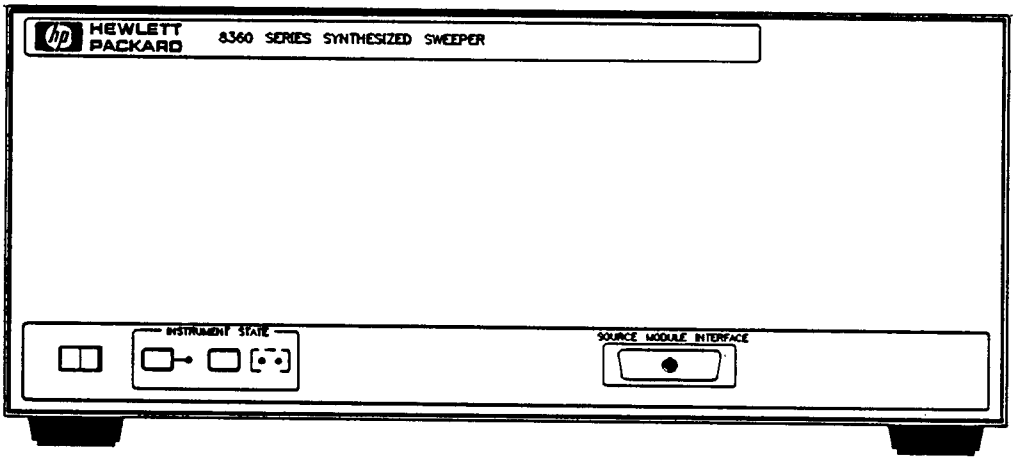


Figure i. HP 83631A Synthesizer

These three synthesizers are part of the HP 8360 series product family, which includes synthesizers having many different configurations. As compared to the main HP 8360 series product family, the HP 83621A/31A/51A synthesizers feature:

- Limited specifications.
- A "blank" front panel.
- Rear panel RF output.
- No options.

Applications and Compatibility

The HP 83621A/31A/51A synthesizers are specialized for use with HP 8510 network analyzer systems. The differences between these synthesizers and the other sources in their product family are important to the specialized applications intended for these synthesizers.

Limited specifications allow for quick performance testing at the customer site, while at the same time include all specifications required of a synthesized source used in an HP 8510 network analyzer system.

A *"blank" front panel* reduces instrument cost and is not required when the synthesizer is operated in an HP 8510 network analyzer system. For performance tests, adjustments, and, troubleshooting, front panel emulation software is included with each synthesizer. When run on an HP 200/300 series controller, the front panel emulator will access the full feature set of the synthesizer.

Rear panel RF output is preferred for convenient RF connections in HP 8510 network analyzer systems.

No options are offered because HP 8510 network analyzer systems do not require the special features sometimes desirable with stand-alone synthesized sources. This also reduces instrument cost.

All HP 8510 systems must have firmware revision 4.0 or greater for compatibility with the HP 83621A/31A/51A synthesizers. Revision 6.0 or greater is required to implement all capabilities (such as Quick Step). Refer to the HP 8510 system documentation for specifics.

Instruments Covered By This Manual

This manual applies directly to HP 83621A/31A/51A synthesized sweepers that have a serial number prefix listed on the title page (see the serial number attached to the synthesizer's rear panel). Figure ii shows a typical serial number label. A prefix (four digits followed by a letter), and a sequential suffix (five digits unique to each instrument), compose the serial number. For serial prefixes lower than those listed on the title page, see the "Instrument History" chapter.

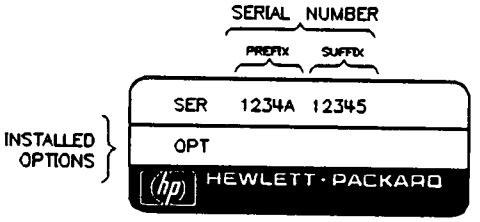


Figure ii. Typical Serial Number Label

How To Order Manuals

The manual part number is listed on the title page of this manual (directly behind the documentation map tab). Use this part number to order extra copies of this manual. See "Replaceable Parts" for a complete list of manual sets and ordering numbers.

Safety Considerations

General

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

Safety Symbols



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).



Indicates hazardous voltages.



Indicates earth (ground) terminal.

Warning



The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

Caution



The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Safety Earth Ground

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power, cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Before Applying Power

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto transformer make sure the common terminal is connected to the neutral (grounded side of the mains supply).

Servicing

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from their power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

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1 EQUIPMENT REQUIRED

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Spectrum Analyzer		HP 8566B[2]	Fractional-N Reference and API Spurs (A)
Frequency Counter	Frequency Range: 45 MHz to 26.5 GHz Stability: Aging Rate 5 x 10^{-10}/day	HP 5343 Option 001	CW Frequency Accuracy (P)
Controller	2.25 Mbyte RAM BASIC 5.1 HP-IB	HP 9836/HP 9920/ HP 310/HP 320	YO Delay (AA) ADC (AA) Power Flatness (AA)
Software	No Substitute (Included in this manual)	HP P/N 08360-10002	YO Delay (AA) ADC (AA) Power Flatness (AA)
DVM	Range: −50 to +10 VDC Accuracy: ±0.01% Input Impedance: ≥ 10 MΩ	HP 3457A	ADC (AA)
Digital Oscilloscope	Dual Channel Bandwidth: DC to 100 MHz Input Impedance: 1 MΩ and 50 MΩ Vertical Sensitivity: ≤ 5 mV/Div Horizontal Sensitivity: 50 ns/Div Trigger: Event Triggerable	HP 54501A/ HP 54111D[2]	10 MHz Standard (A) Low Power SRD Bias (A) Modulator Offset and Gain (A)
Oscilloscope Probes	Division Ratio: 10:1	HP 10431A	
Analog Oscilloscope	A vs B Sweep Mode Vertical Sensitivity: 5 mV/Div Bandwidth: 100 MHz	HP 1740A	Amplifier/Multiplier Adjustments (A) Amplifier/Filter Adjustments (A)
Frequency Standard	Frequency: 10 MHz Stability: > 1 x 10^{-10}/yr	HP 5061A	10 MHz Standard (A)

1 A – Manual Adjustment AA – Automated Adjustment P – Manual Performance Test

2 Recommended model is part of the microwave test station.

Table 1-1. Required Test Equipment (continued)

Instrument	Critical Specifications	Recommended Model	Use[1]
Power Meter	Power Range: 1 μW to 100 mW Accuracy: ±0.02 dB	HP 436A/HP 437A/ HP 438A	Maximum Leveled Power (P) Amplifier/Filter Adjustments (A) Power Flatness (AA) ALC Power Level Accuracy (A)
Power Sensor	Frequency Range: 45 MHz to 2.3 GHz Power Range: 1 μW to 100 mW	HP 8481A	ALC Power Level Accuracy (A) Power Flatness (AA) Maximum Leveled Power (P)
Power Sensor	Frequency Range: 50 MHz to 50 GHz Power Range: 1 μW to 100 mW	HP 8487A	Amplifier/Filter Adjustments (A) ALC Power Level Accuracy (A) Power Flatness (A) Power Flatness (AA) Maximum Leveled Power (P)
Network Analyzer	No Substitution	HP 8510	Swept Frequency Accuracy (P)
Test Set	System Specific	HP 8512 HP 8513 HP 8514 HP 8515 HP 8516 HP 8517	Swept Frequency Accuracy (P)
Attenuator	Frequency Range: 45 MHz to 50 GHz Maximum Input Power: 200 mW Attenuation: 10 dB	HP 8490D Option 010	Maximum Leveled Power (P)
Coaxial Detector	Frequency Range: 0.45 to 50 GHz Maximum Input: 200 mW Polarity: Negative	HP 8473E	Amplifier/Multiplier Adjustments (A)
Tool Kit	No Substitute	HP P/N 08360-60060	

The following list of adapters and cables is provided for convenience. They may be used in equipment setups for performance tests or adjustments.

SMA (m) to SMA (m) adapter	1250-1159
SMA (f) to SMA (f) adapter	1250-1158
SMB (m) to SMB (m) adapter	1250-0669
SMB (f) to SMB (f) adapter	1250-0672
SMB tee (f) (m) (m)	1250-1391
3.5 mm (f) to 3.5 mm (f) adapter	5061-5311
3.5 mm (f) to N-type (m) adapter	1250-1745
2.4 mm (f) to 2.92 mm (f) adapter	1250-2187
2.4 mm (f) to 2.4 mm (f) adapter	1250-2188
2.4 mm (m) to 3.5 mm (f) adapter	11901C
BNC (f) to BNC (f) adapter	1250-0080
BNC (m) to BNC (m) adapter	1250-0216
BNC (f) to SMA (m) adapter	1250-1200
BNC (f) to SMB (m) adapter	1250-1237
BNC tee (m) (f) (f)	1250-0781
SMB (f) to BNC (m) flexible cable	85680-60093
SMA semi-rigid cable 2 feet	08340-20124
BNC male cable 2 feet	8120-3446
BNC cable	8120-2582

2 PERFORMANCE TESTS

2

Performance Tests

How To Use This Chapter

Performance verification for the HP 83621A/31A/51A synthesizers is accomplished during the system verification when the synthesizer is part of an HP 8510 system.

When the synthesizer is part of such a system, refer to the HP 8510 *On-Site Service* manual performance test section for system performance tests, whenever the HP 8510 system is re-verified (at least one year after installation.) Also, perform "Operation Verification" when the synthesizer must be verified by itself. These are performance test procedures, and meet the needs of most incoming inspections (80% verification) by providing a reasonable assurance that the instrument is functioning properly.

Following the operation verification procedure in this chapter are the performance tests which test the electrical performance of the HP 83621A/31A/51A synthesizers as published in "Specifications" in this manual. These tests do not require access to the interior of the instrument.

This chapter contains the following procedures:

- Operation Verification.
- CW Frequency Accuracy performance test.
- Maximum Leveled Power performance test.
- Swept Frequency Accuracy performance test.

When used in an HP 8510 system, the electrical performance of the synthesizer is confirmed when the system is calibrated and verified according to the procedure outlined in the HP 8510 system documentation.

Note: The synthesizer must warm up for at least *one hour* before the electrical specifications are valid.

Calibration Cycle

When used in an HP 8510 system, consult the system documentation to determine the calibration cycle of the entire system and perform the system verification *instead* of these synthesizer performance tests. Whenever used as a stand-alone instrument, perform the tests in this chapter at least once every 24 months.

Front Panel Emulation Software

Front panel emulation software is required to perform the tests in this chapter. The "Automated Tests" chapter explains how to run the front panel emulator software and lists all required hardware.

Whenever a hardkey is mentioned in these performance test procedures, the software-defined "hardkey", associated with the original front panel key, must be pressed. A table listing each of these keys appears in "Utilities" in the "Automated Tests" chapter. The following is a list of common keystrokes in these performance tests and their equivalent front panel emulator software keystrokes.

Instrument	(USER CAL) `Tracking Menu` `AutoTrack` `Peak RF Always`
Controller	(c) (Kn) (Kn) (Kn) (Kn) (Proceed)
Instrument	FREQUENCY (CW) (45) (MHz)
Controller	(W) (45) (M)
Instrument	(SERVICE) `Selftest (Full)`
Controller	(S) (Kn)
Instrument	(START) (45) (MHz)
Controller	(A) (45) (M)
Instrument	(STOP) (20) (GHz)
Controller	(o) (20) (G)
Instrument	SWEEP (MENU) `Manual Sweep`
Controller	(E) (Kn)

Note: There are some differences between the front panel emulation software supplied with the synthesizer manual and the HP 8510 front panel emulator software. The five softkeys below the display are designated either with a [K] or an [F]. The hardkeys [USER CAL] and [SERVICE] appear as softkeys in the HP 8510 version; however, they are designated the same as other hardkeys in the software supplied with the manual.

There are several ways to implement front panel emulation software:

HP 8510C

Front panel emulation software is contained in the HP 8510C. The keypad overlay that is needed for the network analyzer is a part of the front panel emulator kit that is shipped with each HP 83621A/31A/51A synthesizer.

To run the front panel emulation software, on the network analyzer, press:
AUXILIARY MENUS [SYSTEM]
SERVICE FUNCTIONS
TEST MENU
[22] (RUN SERVICE PROGRAM) [=MARKER]
[4] (8360 TESTS) [=MARKER]
[2] (FRONT PANEL EMULATOR) [=MARKER]

Front Panel Emulator Kit

The front panel emulator kit (shipped with each HP 83621A/31A/51A synthesizer) contains the software on tape for use with the HP 8510B. The kit also includes the network analyzer overlay and instructions for using the software. Some early versions of the HP 83621A/31A were shipped before the creation of the front panel emulator kit. See "Replaceable Parts" for the part number to order the front panel emulator kit.

Computer-Run Software

Front panel emulation software that runs on an HP 9000 series 200/300 computer is shipped with each HP 83621A/31A/51A as part of the manual set.

Menu Maps

Fold-out menu maps are located in chapter 6.

Some menus have more than one page of softkeys. Select the [more] softkey to view the next page of softkeys; [more] is *not* included in the keystrokes given in these procedures.

Note: In all cases where you are instructed to preset the synthesizer, use the factory preset mode only.

Equipment Required

The equipment required to perform the tests in this chapter is listed in chapter 1, "Equipment Required". You may use any equipment that meets the critical specifications given.

Operation Verification

Do these procedures in the order given.

The operation verification form is supplied at the end of the procedure. Use the form to record the pass/fail results of an operation verification.

1. Self-tests

1. Perform the full self-tests contained in the instrument firmware using the front panel emulator software. No additional test equipment is required. Press (SERVICE) `Selftest (Full)`.

   The synthesizer executes a series of self-tests. When completed, the following message is displayed if all the tests passed:

   ```
   ALL SELF-TESTS HAVE PASSED!
   ```

2. Record *Pass* on the operation verification form and continue to the next test, "CW Frequency Accuracy".

   If the synthesizer fails one or more self-tests, a different message is displayed listing the most independent test that failed and a reference to the best entry point into the *Troubleshooting* manual. Record *Fail* on the operation verification form and see the *Troubleshooting* manual. After repair, repeat operation verification from the beginning.

2. CW Frequency Accuracy

1. Follow the "CW Frequency Accuracy" procedure given in "Performance Tests" in this manual.
2. If the synthesizer passes this test, record *Pass* on the operation verification form and continue to the next test, "Maximum Leveled Power".

   If the synthesizer fails, record *Fail* on the operation verification form and then follow the "In Case of Difficulty" instructions given for this

performance test. After repair, repeat operation verification from the beginning.

3. Maximum Leveled Power

1. Follow the procedure given in "Performance Tests" in this manual.
2. If the synthesizer passes this test, record *Pass* on the operation verification form. Operation verification is completed.

   If the synthesizer fails, record *Fail* on the operation verification form and then follow the "In Case of Difficulty" instructions given for this performance test. After repair, repeat operation verification from the beginning.

Table 2-1. HP 83621A/31A/51A Operation Verification Form

Test Facility _____	Date _____
Model _____	Customer _____
Serial Number _____	Tested By _____
Options _____	Firmware Revision _____

Test	Results (Pass/Fail)
1. Self-Tests	_____
2. CW Frequency Accuracy	_____
3. Maximum Leveled Power	_____

Performance Tests

Perform the tests in the order that they appear using the front panel emulation software. (Refer to the beginning of this chapter for more information on front panel emulation software.)

A performance test record is supplied at the end of this chapter. Use the performance test record when you perform a full calibration of your synthesizer. The performance test record gives the acceptable limits of the performance tests and a column to record worst-case measurements.

1. CW Frequency Accuracy

Description and Procedure

In this procedure, a frequency counter is used to measure the minimum and maximum synthesizer frequencies in CW. In the HP 83651A, an internal frequency doubler is used to generate frequencies of $\geq$ 26.5 GHz through 50 GHz. Since the highest frequency that the frequency counter can measure is 26.5 GHz, the doubler is disabled for the measurement at 50 GHz providing an RF output of 25 GHz. This verifies a 50 GHz output except for the operation of the doubler. Since the doubler is engaged to produce the 26.5 GHz RF output, the operation of the doubler is verified in the 26.5 GHz measurement.

Self-tests then verify that the internal hardware is properly maintaining frequency accuracy over the full frequency range.

1. Connect the equipment as shown in Figure 2-1. Preset the instruments and let them warm up for at least one hour.

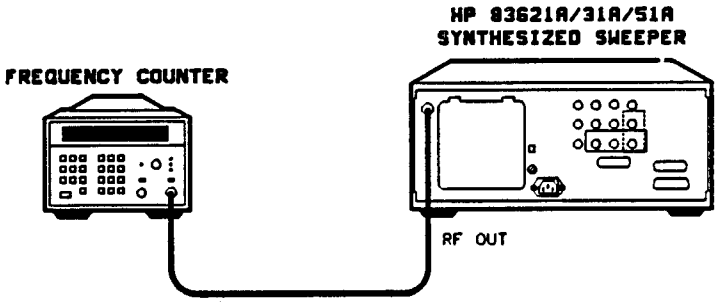


Figure 2-1. CW Accuracy Test Setup

2. On the synthesizer, set:
   (CW) (45) (MHz)

   Measure the frequency with the counter and record this value in the test record located at the end of this chapter.

3. ■ On the HP 83621A, set:
   CW 20 GHz
   ■ On the HP 83631A/51A, set:
   CW 26.5 GHz

   Measure the frequency with the counter and record this value in the test record located at the end of this chapter.

4. On the HP 83651A, set:
   CW 50 GHz
   SERVICE Tools Menu Disable Doubler (asterisk on)

   Measure the frequency with the counter and record this value in the test record located at the end of this chapter.

5. Run the self-tests to verify that the instrument hardware is functioning properly, indicating that frequency accuracy is maintained over the remaining frequency range of the synthesizer.

   On the synthesizer, set:
   SERVICE Selftest (Full)

   Run the self-tests using the front panel emulator software to verify that the instrument hardware is functioning properly.

Related Adjustments

10 MHz Standard

In Case of Difficulty

1. Make sure the frequency counter has a current calibration sticker and that it meets its published specifications.
2. Refer to the *Troubleshooting* manual.

2. Maximum Leveled Power

Description and Procedure

This procedure uses a power meter to measure the maximum leveled power of the synthesizer at periodic frequencies across the band. Using the front panel emulator, an auto track is invoked so that the YTM and the YIG oscillator are tracked to obtain the maximum output power. The up and down arrow keys are used to set the maximum leveled power out of the synthesized sweeper across the band.

Power level is increased in swept mode until the unleveled message comes on. The power is then decreased until the message disappears. Manual sweep is used to verify an unleveled condition does not occur at slow sweep speeds. The minimum leveled power point is identified by measuring the power level in 200 MHz steps across the frequency range.)

1. Connect the equipment as shown in Figure 2-2. Let the power meter warm up for at least one hour. Calibrate and zero the power meter.

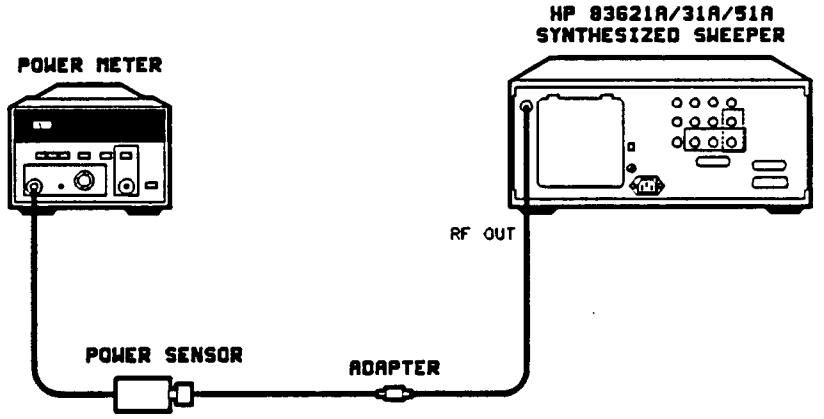


Figure 2-2. Maximum Leveled Power Setup

Note: Before continuing, make sure that the power sensor is attached to the synthesizer RF output connector. A good match for the synthesizer RF output connector is necessary in order for the synthesizer power leveling circuitry to operate properly.

2. On the synthesizer, set:
   (PRESET) (USER CAL) Tracking Menu AutoTrack Proceed

   This initiates a synthesizer autotrack. Wait until the autotrack is completed. The front panel emulator software may or may not indicate that autotrack is running. When it is done, the caution message on the computer display will be replaced by a frequency and power level display.

3. On the synthesizer, set:
   (START) (45) (MHz)
   (STOP) (20) (GHz)

4. Press (POWER LEVEL) to make power level the active function. The left and right arrow keys in this step select the significant digit to change; the up and down arrow keys increase or decrease the value respectively.

   Press the arrow keys to increase the power level until the unleveled indicator comes on. When the unleveled message appears, it will be located under the power level indication at the right-hand side of the emulated front panel "display".

5. Decrease the power until the unleveled message disappears. Select 0.1 dB resolution and set the power level to 0.1 dB less than the level at which the unleveled message disappears.

6. On the synthesizer set:
   SWEEP (MENU) Manual Sweep

   Manually sweep over the full frequency range and note any unleveled messages. Decrease the power level so that no unleveled messages appear.

Note: The left and right arrow keys used in this step select the significant digit to change; the up and down arrow keys increase or decrease the value respectively.

Change the power meter sensor calibration factor as necessary to keep the power reading calibrated.

7. Use the up/down arrow keys on the keyboard to manually sweep across the full frequency range of the synthesizer in 200 MHz steps. Observe the power meter (*not* the indicator on the computer screen generated by the front panel emulator software) as this is done and note the minimum power point.

8. Record this minimum power point as the maximum leveled power level on the test record at the end of this section.
9. On the synthesizer, set [CONT] SWEEP.
10. ■ For the HP 83631A only:
    a. On the synthesizer, set [STOP] [26.5] [GHz]
    b. Repeat steps 4 through 8 *except* in step 7 manually sweep from 20 GHz to 26.5 GHz in 200 MHz steps.

    ■ For the HP 83651A only:
    a. On the synthesizer, set [STOP] [26.5] [GHz]
    b. Repeat steps 4 through 9 *except* in step 7 manually sweep from 20 GHz to 26.5 GHz in 200 MHz steps.
    c. On the synthesizer, set [STOP] [40] [GHz]
    d. Repeat steps 4 through 9 *except* in step 7 manually sweep from 26.5 GHz to 40 GHz in 200 MHz steps.
    e. On the synthesizer, set [STOP] [50] [GHz]
    f. Repeat steps 4 through 8 *except* in step 7 manually sweep from 40 GHz to 50 GHz in 200 MHz steps.

Related Adjustments

1. Amplifier/Multiplier Adjustments
2. Amplifier/Filter Adjustments
3. Modulator Offset and Gain

In Case of Difficulty

Refer to the *Troubleshooting* manual.

3. Swept Frequency Accuracy

Description and Procedure

The HP 8510 network analyzer system is set up for a phase measurement using a cable to connect the test ports together. This test relies on the electrical length of the cable being sufficiently different from the reference path so a small change in frequency will cause a measurable phase shift.

The display is calibrated to 10 MHz/division: A reference point is set at a specific CW frequency. The synthesizer is then shifted 5 MHz in frequency, and the display scale is adjusted for a 5 division change in the display (1 MHz per division). The display scale is then increased by a factor of 10. This scale is maintained throughout the remainder of the procedure.

The synthesizer is then put into stepped sweep mode. Since the source is synthesized, the result is a trace with zero frequency error. This trace is stored into memory and subtracted from the reference. The result is a straight line. The synthesizer is then put into ramp sweep mode and sweep span cal is automatically invoked to minimize frequency errors. The resultant display indicates swept frequency accuracy.

1. Connect the equipment as shown in Figure 2-3. Preset the instruments and let them warm up for at least one hour.

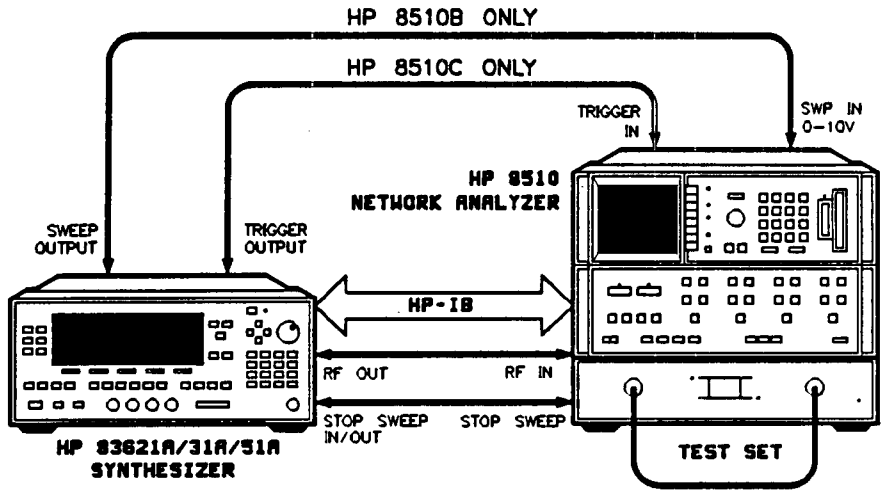


Figure 2-3. Swept Frequency Accuracy Setup

2. On the synthesizer, set:
   (PRESET) (USER CAL) Tracking Menu AutoTrack Proceed

   This initiates a synthesizer autotrack. Wait for the autotrack to complete. The front panel emulator software may or may not indicate that autotrack is running. When it is done, the caution message on the computer display will be replaced by a frequency and power level display.

3. Follow the instructions on the display to exit the front panel emulator software.

   During the rest of the procedure the HP 8510 is used to control the synthesizer.

4. On the HP 8510, set:
   CHANNEL 1
   STIMULUS (START) (2.3) (G/n)
   STIMULUS (STOP) (20) (G/n)
   STIMULUS (MENU) (SWEEP TIME) (200) (k/m)
   STIMULUS (MENU) (SINGLE POINT)

   The center CW frequency should be 11.15 GHz as shown at the bottom of the display. On the HP 8510, set:

PARAMETER [S12]
FORMAT [PHASE]

Display Calibration

Note: This is a sensitive calibration to achieve and may require several repetitions of the next steps. The following table may help to reduce adjustment time during these iterations.

Frequency (GHz)	Adjustment	Trace Position
11.150	Ref Value	Center
11.155	Scale	Display Edge[1]
11.145	Scale	Display Edge[1]

1 Either top or bottom of display.

5. Press RESPONSE [REF VALUE]. Turn the RPG (rotary pulse generator) to center the trace on the display horizontal reference line.
6. Press RESPONSE [SCALE] [10] [x1] to expand the display scale.
7. Press RESPONSE [REF VALUE]. Readjust the RPG to center the trace on the reference line.
8. Press STIMULUS [CENTER] [11.155] [G/n] to increase the center frequency by 5 MHz.
9. The trace will move above or below the center reference established in step 7. Press RESPONSE [SCALE] and move the RPG to position the trace on the closest display edge (top or bottom of the screen).

Note: Vary the RPG only so much as to put the trace on the screen edge and no farther. The trace should appear "jumpy". If it does not, back off on the RPG until it is.

10. Press STIMULUS [CENTER] [11.145] [G/n] to set the center frequency 5 MHz less than that represented on the center reference line. The trace should move to the display edge opposite that in steps 8 and 9.

11. If necessary, select RESPONSE [SCALE] and adjust the RPG to position the trace on the closest display edge (top or bottom).
12. Set stimulus center to 11.15 GHz.
13. Repeat steps 7 through 12 until the change in center frequency places each trace on the appropriate graticule with no further adjustment.

Note: If a "Phase Lock Lost" error appears on the display, repeat this procedure beginning with step 6.

14. Press RESPONSE [SCALE] and enter a value that is ten times the present value. For example, if the scale value is now 420 milli-degree/div, then increase it to 4.2 degrees/div. The display is now calibrated for delta F = 10 MHz/div.

Swept Frequency Accuracy Measurement

15. Press STIMULUS [MENU] [STEP] to select stepped sweep mode.
16. Press STIMULUS [START] [45] [M/μ] to set the start frequency to 45 MHz.

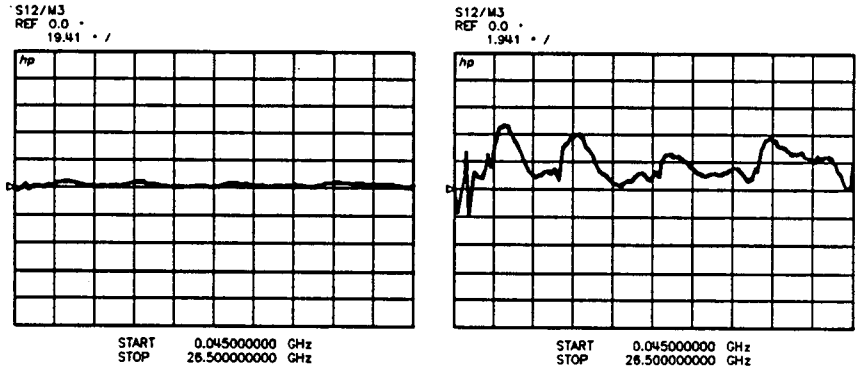
    Press STIMULUS [STOP] [20] [G/n] (HP 83621A) *or*
    STIMULUS [STOP] [26.5] [M/μ] (HP 83631A and 83651A) to set the stop frequency.
17. Wait for the HP 8510 to complete the sweep (the asterisk in the upper left corner of the display turns off), and then press DISPLAY `Data→Memory n` to store the trace data.
18. Press `MATH (/)`. The HP 8510 mathematically subtracts memory from the trace to provide a flat reference.
19. Press RESPONSE [REF VALUE] [0] [x1] to set the center reference line to 0 degrees.
20. Press STIMULUS [MENU] [RAMP] to choose ramp sweep mode.
21. Press STIMULUS [MENU] [SWEEP TIME] [500] [k/m] to set the sweep time to 500 ms.
22. Figure 2-4 shows a typical response at two scale sensitivities. Locate the portion of the trace farthest from the center reference graticule. This is the worst-case swept frequency accuracy. Record this value in the performance

test record at the end of this section. The scale is set in this procedure to 10 MHz per division. However, if this scale does not provide enough resolution you can change the sensitivity as follows:

For any change in MHz/division, make a proportional change in scale. For example,

To change the frequency/division from 10 MHz/division to 5 MHz/division, divide the scale by 2 (for example, if it was 4.2°/division, change it to 2.1°/division).

Or, to change the frequency/division from 10 MHz/division to 1 MHz/division, divide the scale by 10 (for example, if it was 4.2°/division, change it to 0.042°/division).



(a) 10MHz/Div. (b) 1MHz/Div.

Figure 2-4. Bandswitch Transition Location

For the HP 83651A Only:

23. Reset the scale, if you have changed it, so that the frequency/division is 10 MHz/division.
24. Press STIMULUS (MENU) (STEP) to select stepped sweep mode.
25. Press STIMULUS (START) (45) (M/μ) to set the start frequency to 45 MHz.

    Press STIMULUS (STOP) (50) (G/n) to set the stop frequency.

26. Wait for the HP 8510 to complete the sweep, and then press DISPLAY `Data→Memory n` to store the trace data.

27. Press `MATH (/)`. The HP 8510 mathematically subtracts memory from the trace to provide a flat reference.

28. Press RESPONSE [REF VALUE] [0] [x1] to set the center reference line to 0 degrees.

29. Press STIMULUS [MENU] [RAMP] to choose ramp sweep mode.

30. Press STIMULUS [MENU] [SWEEP TIME] [1] [x1] to set the sweep time to 1 second.

31. Locate the portion of the trace farthest from the center reference graticule. This is the worst-case swept frequency accuracy. Record this value in the performance test record at the end of this section. The scale is set in this procedure to 10 MHz per division. However, if this scale does not provide enough resolution you can change the sensitivity as follows:

    For any change in MHz/division, make a proportional change in scale. For example,

    To change the frequency/division from 10 MHz/division to 5 MHz/division, divide the scale by 2 (for example, if it was 4.2°/division, change it to 2.1°/division).

    Or, to change the frequency/division from 10 MHz/division to 1 MHz/division, divide the scale by 10 (for example, if it was 4.2°/division, change it to 0.042°/division).

Related Adjustments

1. YO Driver +10V Reference
2. YO Gain and Linearity
3. YO Delay Compensation
4. Sweep Ramp Calibration

In Case of Difficulty

1. Make certain that the phase difference between the test set reference path and the cable connecting the test set ports causes at least a scale of 200 milli-degrees/division.
2. Refer to the *Troubleshooting* manual.

Table 2-2.
HP 83621A/31A/51A Performance Test Record (1 of 3)

Test Facility:_____ Report Number _____

_____ Date _____

_____ Customer _____

_____ Tested by _____

Model _____ Ambient temperature _____ °C

Serial Number _____ Relative humidity _____ %

Options _____ Line frequency _____ Hz (nominal)

Firmware Revision _____

Special Notes:

_____

_____

_____

_____

_____

Table 2-2. HP 83621A/31A/51A Performance Test Record (2 of 3)

Model _____ Report Number _____ Date _____

Test Equipment Used	Model Number	Trace Number	Cal Due Date
1. Frequency Counter			
2. Oscilloscope			
3. Power Sensor			
4. Power Meter			
5. Network Analyzer			
6. Test Set			
7. _____			
8. _____			
9. _____			
10. _____			
11. _____			
12. _____			
13. _____			
14. _____			
15. _____			
16. _____			
17. _____			

Table 2-2. HP 83621A/31A/51A Performance Test Record (3 of 3)

Model		Report Number			Date
Test No.	Test Description	Minimum Spec.	Results	Maximum Spec.	Measurement Uncertainty[1]
1.	CW Frequency Accuracy				
	Worst Case Value:				
	2. 45 MHz	44.999955 MHz	_____	45.000045 MHz	±10 Hz
	3. 20 GHz[2]	19.99998 GHz	_____	20.00002 GHz	±4 kHz
	26.5 GHz[3]	26.4999735 GHz	_____	26.5000265 GHz	±5 kHz
	50 GHz[4]	24.999975 GHz	_____	25.000025 GHz	±5 kHz
2.	Maximum Leveled Power				
	9. 45 MHz to 20 GHz	+10 dBm	_____		±0.44 dB
	11. 20 GHz to 26.5 GHz[3]	+4 dBm	_____		±0.4 dB
	26.5 GHz to 40 GHz[4]	+3 dBm	_____		±0.5 dB
	40 GHz to 50 GHz[4]	0 dBm	_____		±0.9 dB
3.	Swept Frequency Accuracy				
	Worst Case Value:				
	22. Start Freq_____			0.1% of sweep	±150 kHz
	Stop Freq_____		_____		
	Worst Case Value:[4]				
	30. Start Freq_____			0.1% of sweep	±150 kHz
	Stop Freq_____		_____		

1 The measurement uncertainty is quoted for these performance tests using only the recommended models specified in the "Equipment Required" chapter. The measurement uncertainty quoted represents limits of ±3 times the equivalent standard deviation (3σ) and is intended to represent a 99% confidence level.

2 HP 83621A only.

3 HP 83631A/51A only.

4 HP 83651A only.

3 ADJUSTMENTS

3

Adjustments

How To Use This Chapter

Perform these adjustments only if directed by the *Troubleshooting* manual or if a performance test fails.

Menu Maps

Fold-out menu maps are located in chapter 6.

Some menus have more than one page of softkeys. Select the `More` softkey to view the next page of softkeys. `More` is *not* included in the keystrokes given in these procedures.

Note: In all cases where you are instructed to preset the synthesizer, use the factory preset mode only.

If a password is set, it will have to be disabled before the adjustment menu can be accessed. See "Calibration Constants" in this manual for instructions.

Equipment Required

The equipment required to perform the adjustments in this chapter is listed in the "Equipment Required" chapter of this manual. You may use any equipment that satisfies the critical specifications given. Use a *non-metallic* adjustment tool.

Cautions And Warnings

Although this instrument has been designed in accordance with international safety standards, for safe operation you must follow the cautions and warnings in this manual.

Warning **Voltages in the instrument can cause personal injury; be extremely careful. Capacitors can be charged even if the instrument has been disconnected from line power.**



This chapter contains the following adjustments:

- 10 MHz Standard
- Fractional-N VCO
- Fractional-N Reference and API Spurs
- Sweep Ramp
- Sampler Assembly
- YO Driver +10V Reference
- YO Driver Gain and Linearity
- YO Loop Gain
- Amplifier/Multiplier Adjustments
- Amplifier/Filter Adjustments (HP 83651A)
- Low Power SRD Bias
- Modulator Offset and Gain
- ALC Power Level Accuracy

For the following adjustments, see "Automated Tests":

- YO Delay Adjustment.
- ADC Adjustment.
- Power Flatness.

1. 10 MHz Standard

Description and Procedure

This procedure adjusts the frequency accuracy of the internal 10 MHz time base. This adjustment should be done on a regular basis if absolute frequency accuracy is important (see Figure 3-3.)

For best accuracy, readjust the 10 MHz timebase oscillator after the synthesizer has been on or in standby for 24 hours. See "Accuracy Versus Adjustment Interval," following this adjustment, for information on how to determine a periodic adjustment schedule.

After the timebase is adjusted, the timebase frequency should stay within the aging rate if the following things happen:

- The time base oven does not cool down.
- The instrument keeps the same orientation with respect to the earth's magnetic field.
- The instrument stays at the same altitude.
- The instrument does not receive any mechanical shock.

If the time base oven cools (the instrument is disconnected from AC power), you may have to readjust the time base frequency after a new warm-up cycle. Typically, however, the time base frequency returns to within ±1 Hz of the original frequency.

Note: You can adjust the internal timebase after reconnecting AC power for 10 minutes, but for best accuracy, test again after the instrument has been on or in standby for 24 hours.

Frequency changes, due either to a change in orientation with respect to the earth's magnetic field or to a change in altitude, are usually eliminated when the instrument is returned to its original position. A frequency change due to mechanical shock usually appears as a fixed frequency error.

1. Connect the equipment as shown in Figure 3-1. Preset all instruments and let them warm up for one hour.

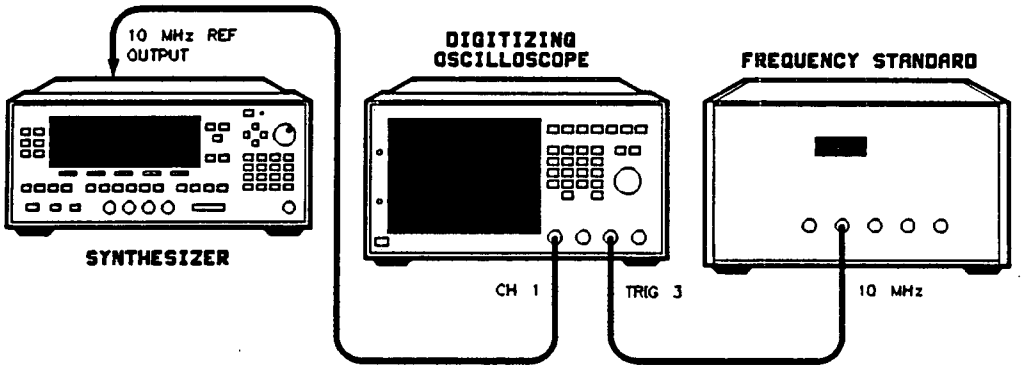


Figure 3-1. 10 MHz Standard Adjustment Setup

Note: If the oscilloscope does not have a 50Ω input impedance, connect channel 1 through a 50Ω feedthrough.

2. On the oscilloscope, set:

Channel 1:	
Display	On
Volts/Division	200 mV
Input Coupling	dc
Input Impedance	50Ω
Channel 2:	
Display	Off
Timebase:	
Time/Division	10 ns
Trigger	External
Trigger:	
Trigger Mode	Edge
Trigger Source	Trig 3
Input Coupling	ac
Display:	
Display Mode	Real Time

3. On the oscilloscope, adjust the trigger level so that the sweep is synchronized to the synthesizer's internal standard. The waveform will appear to drift.
4. Using a non-metallic tool, adjust the A23 10 MHz standard (see Figure 3-2) for minimum horizontal movement of the oscilloscope waveform.

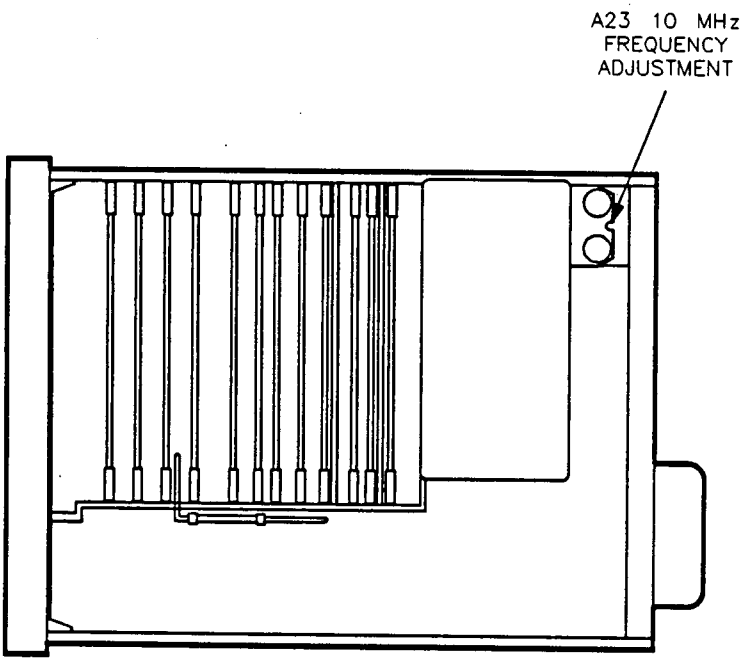


Figure 3-2. 10 MHz Standard Adjustment Location

Related Performance Tests

Internal Timebase: Aging Rate

In Case of Difficulty

1. Ensure that an external standard is not connected. (At instrument preset the synthesizer automatically chooses the external standard as the reference if one is connected to the 10 MHz REF INPUT.)
2. Refer to the *Troubleshooting* manual.

Accuracy Versus Adjustment Interval

Figure 3-3 shows the required adjustment interval to maintain a given accuracy. If you know the aging rate, you can determine a more precise adjustment interval.

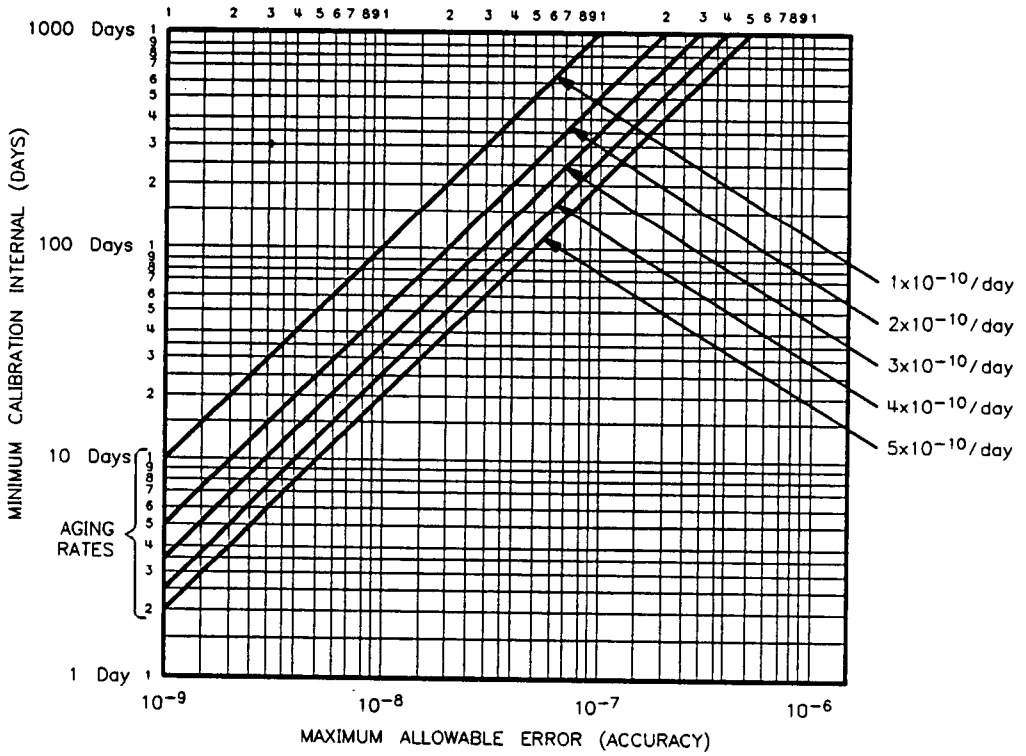


Figure 3-3. Accuracy Versus Adjustment Interval

1. Find the line on Figure 3-3 that corresponds to the 10 MHz timebase oscillator aging rate (to determine the aging rate, see "Performance Tests").
2. On the horizontal axis, find the maximum allowable error (accuracy) that you want.
3. Follow the maximum allowable error vertically until it intersects the known aging rate.

4. From the point of intersection, move horizontally to the left and read the minimum calibration interval measured in days.

An Alternate Method

You can also determine the minimum calibration interval using the following formula:

$$\frac{\text{maximum allowable error}}{\text{known aging rate (per day)}} = \text{calibration interval in days}$$

2. Fractional-N VCO

Description and Procedure

No test equipment is required for this procedure.

This adjustment sets the VCO tuning voltage to −6.0 V for a VCO output of 60 MHz.

1. Leaving all cables connected, place the A4 fractional-N assembly on an analog extender board.
2. Turn the synthesizer on and press (PRESET). Let the instrument warm up for at least one hour.
3. Select the A4 VCO tune adjustment. On the synthesizer, set:
   (SERVICE) `Adjust Menu` `AssyAdj Menu` `A4 VCO Tune`
4. Using a non-metallic tool, adjust A4L1 (see Figure 3-4) to center the needle on the display.

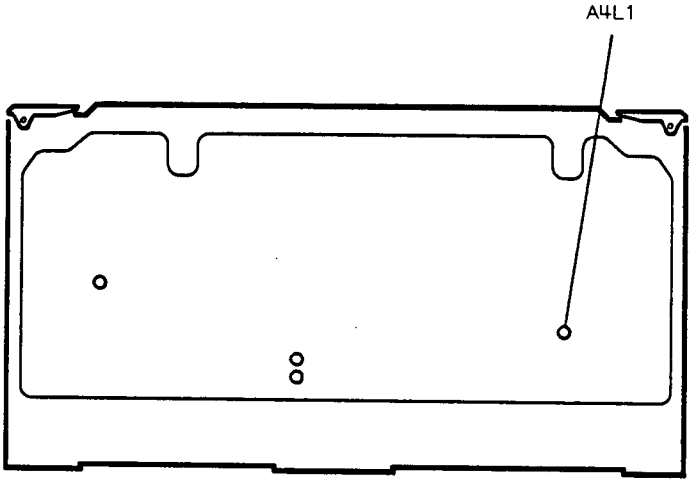


Figure 3-4. A4L1 Location

5. Turn the synthesizer to standby, and reinstall the A4 assembly.

Related Performance Tests

Self-tests

In Case of Difficulty

1. Verify that an analog extender board is used.
2. Make sure the 125 kHz reference cable, W11, is connected to A4J1.
3. Refer to the *Troubleshooting* manual.

3. Fractional-N Reference and API Spurs

Note: Do *not* perform this adjustment on a new or rebuilt replacement assembly. The A4 assembly is factory-adjusted, and is *not* instrument dependent.

Description and Procedure

This adjustment minimizes three known spurs (125 kHz reference, API1, and API2). At each spur frequency, the spectrum analyzer is phase locked to the synthesizer, connected directly to the A4 fractional-N assembly output, and operated in zero span. A4R70, R31, and R30 are adjusted for minimum spur level. Table 3-1 summarizes this adjustment.

Table 3-1.
Summary of Fractional-N Reference & API Spurs Adjustment

Spur	Fractional-N CW Frequency (MHz)	Analyzer Frequency (MHz)	Potentiometer	Minimum dBc
125 kHz Reference	44.125	44.0	A4R70	−75
API 1	44.005	44.0	A4R31	−70
API 2	44.0005	44.0055	A4R30	−80

1. With the A4 assembly on an analog extender board, connect the equipment as shown in Figure 3-5. Preset the instruments, and let them warm up for at least one hour.

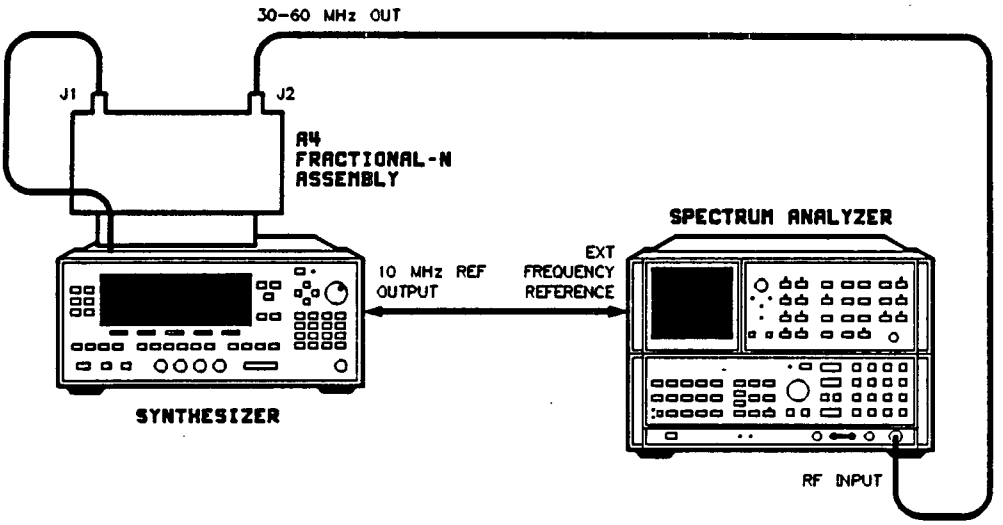


Figure 3-5. Fractional-N Reference and API Spur Adjustment Setup

2. On the spectrum analyzer, set:

Frequency Span:	0 Hz
Resolution Bandwidth:	10 Hz
Sweep Time:	10 s
Reference Level:	−10 dBm
Scale Log:	10 dB/Division
Video Averaging:	Off
Clear Write A:	Selected

125 kHz Reference Spur Adjustment

3. On the synthesizer, set:
   [CW]
   [SERVICE] Tools Menu CntlPLL Menu Frac N Menu
   [CW] [44.125] [MHz]

4. On the spectrum analyzer, set:

Center Frequency:	44.125 MHz
Frequency Span:	500 Hz

Adjust the frequency offset to center the signal on the display.

Frequency Span:	0 Hz

Peak the signal on the display.

Note the signal level:	_____dBm
Center Frequency:	44.0 MHz
Reference Level:	−40 dBm

5. On the synthesizer, adjust A4R70 (see Figure 3-6) for minimum signal on the spectrum analyzer.

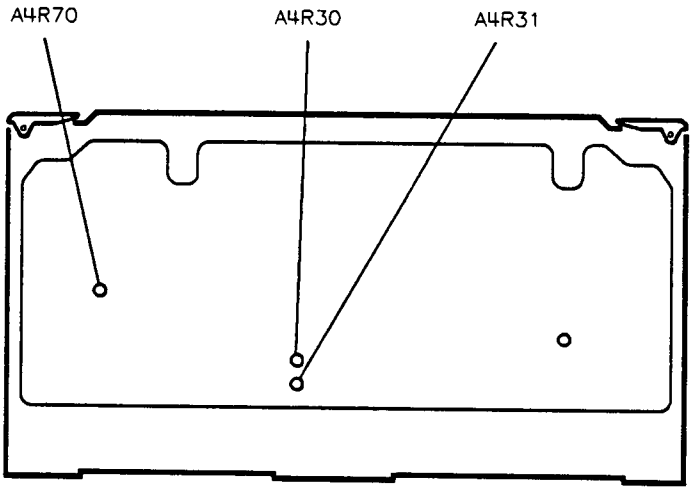


Figure 3-6. Fractional-N Reference and API Spurs Adjustment Locations

The difference in level between the signal noted in step 4 and the signal in this step should be at least −75 dBc.

API 1 Spur Adjustment

6. On the synthesizer, change the fractional-N to CW 44.005 MHz. Press: (44.005) (MHz)
7. On the spectrum analyzer, set:

Center Frequency:	44.005 MHz
Reference Level:	+10 dBm
Note the signal level:	_____dBm
Center Frequency:	44.0 MHz
Reference Level:	−40 dBm

8. On the synthesizer, adjust A4R31 (see Figure 3-6) for minimum signal on the spectrum analyzer.

   The difference in level between the signal noted in step 7 and the signal in this step should be at least −70 dBc.

API 2 Spur Adjustment

9. On the synthesizer, change the fractional-N to CW 44.0005 MHz. Press (44.0005) (MHz)
10. On the spectrum analyzer, set:

Center Frequency:	44.0005 MHz
Reference Level:	+10 dBm
Note the signal level:	_____dBm
Center Frequency:	44.0055 MHz
Reference Level:	−40 dBm

11. On the synthesizer, adjust A4R30 (see Figure 3-6) for minimum signal on the spectrum analyzer.

    The difference in level between the signal noted in step 10 and the signal in this step should be at least −80 dBc.
12. Turn the synthesizer to standby and reinstall the A4 assembly.

Related Performance Tests

None

In Case of Difficulty

1. Ensure that the spectrum analyzer is locked to the external reference.
2. You may need to use video averaging on the spectrum analyzer if the spur level is low enough to be hidden by phase noise.
3. If you cannot adjust spurs below the recommended levels, the problem is probably with the A4 fractional-N assembly. Refer to the *Troubleshooting* manual.

4. Sweep Ramp

Description and Procedure

No test equipment is required for this adjustment.

This is an automatic adjustment. The synthesizer's internal DVM measures the sweep ramp voltage at the end of the sweep. The synthesizer then sets the sweep time calibration constants to calibrate the sweep ramp.

1. Turn the synthesizer on and press (PRESET). Let the synthesizer warm up for at least one hour.
2. Select the A14 sweep ramp adjustment. On the synthesizer, set:
   (SERVICE) `Adjust Menu` `AssyAdj Menu` `A14 SwpRmp`

   The synthesizer will measure, calculate, and store the sweep time calibration constants. When the adjustment is complete, the following message appears on the display:

   ```
   Sweep Ramp Cal Completed
   Calibration constants were modified.
   ```
3. If this is the last calibration constant you will be adjusting, see "Calibration Constants" to store the calibration constants as protected data (in EEPROM).

Related Performance Tests

Self-Tests
Swept Frequency Accuracy

In Case of Difficulty

Refer to the *Troubleshooting* manual.

5. Sampler Assembly

Description and Procedure

No test equipment is required for this procedure.

There are three sampler assembly adjustments:

- In the sampler match adjustment, as the internal DVM monitors the loop input to the sampler, trim capacitors are adjusted to optimize the sampler match over the full frequency range of the loop.
- The 200 MHz loop gain adjustment is automatic. When this adjustment is selected in the A6 adjustment menu, the synthesizer selects internal calibration constants for optimum loop gain over the full frequency range of the loop.
- In the IF gain adjustment, the IF amplifier gain is adjusted as the internal DVM monitors the IF output level to the YO loop.

1. Turn the synthesizer to standby. At FL2 (see Figure 3-7), disconnect the semi-rigid cable between FL2 and the A6 assembly.

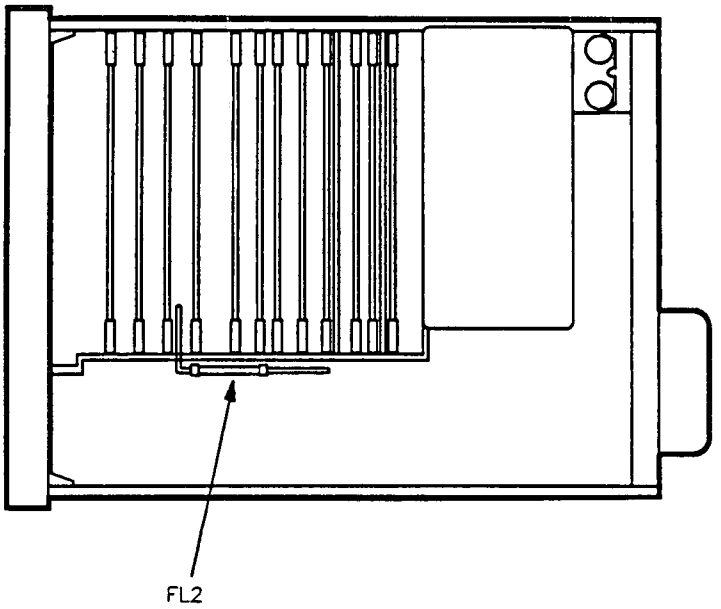


Figure 3-7. FL2 Location

2. Leaving the flexible cable connected to A6J1 (40 MHz reference), place the A6 assembly on the analog extender board.
3. Turn the synthesizer on and press (PRESET). Let it warm up for at least one hour.
4. Select the A6 adjustment menu. Press:
   (SERVICE) `Adjust Menu` `AssyAdj Menu` `A6 Adj Menu`

200 MHz Loop VCO Tune Check

5. In the A6 adjustment menu, select the A6 VCO tune check `A6 VCO Tune`.
6. The following message should be displayed:
   `Ctrim and C60 are OK.`

   If this message is not displayed, refer to troubleshooting.

Note: If the three tuning voltages at the bottom of the display (V200, Vavg, and V220) are all equal, the 200 MHz phase-locked loop is unlocked.

7. Select Done.

Sampler Match Adjustment

8. In the A6 adjustment menu, select the A6 sampler match adjustment, A6 Smplr Match.

Note: The sampler match display is a graphic representation of the sampler match over the full frequency range of the 200 MHz loop. The more asterisks displayed at a frequency, the more output signal (and the better the match) at that frequency. Make the adjustment for best match over the full frequency range of the loop.

9. Adjust A6C82 and A6C83 (Figure 3-8) for best overall sampler match.

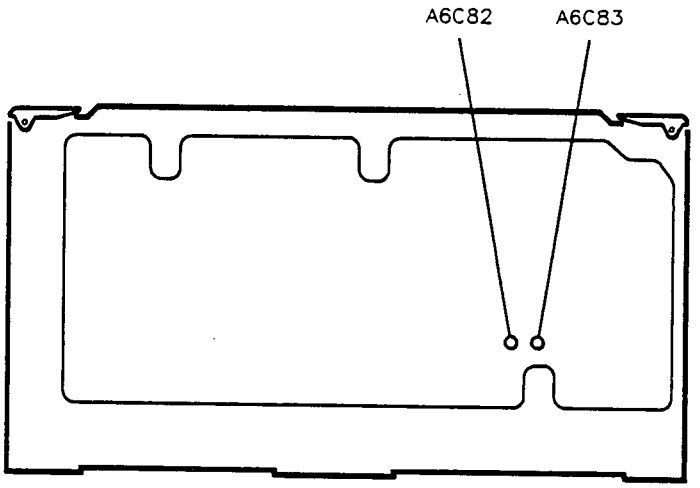


Figure 3-8. Sampler Match Adjustment Locations

10. Select Done.

200 MHz Loop Gain Adjustment

11. In the A6 adjustment menu, select the A6 loop gain adjustment, A6 Loop Gain. The synthesizer automatically performs the adjustment. When the message Calibration Constants should be SAVED is displayed, the adjustment is complete. Continue with the next step.

12. Set the synthesizer to standby. Reinstall the A6 assembly in the instrument, and connect all cables.

IF Gain Adjustment

13. Turn the synthesizer on. Select `A6 IF Gain`.

14. Adjust A6R73 (see Figure 3-9) to center the "needle" on the display.

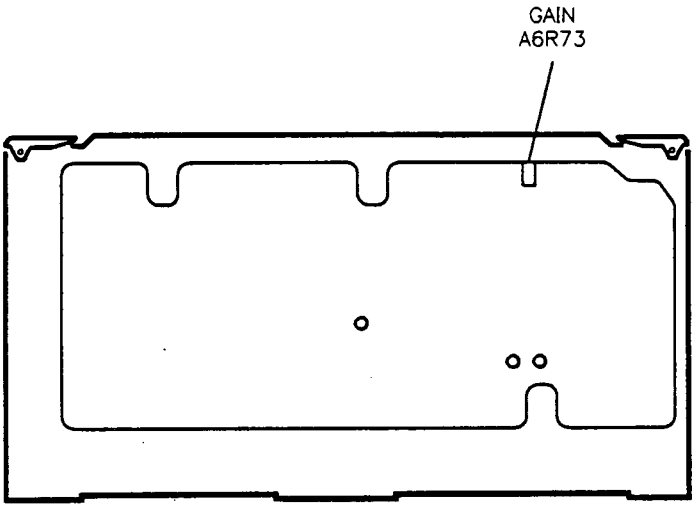


Figure 3-9. IF Gain Adjustment Location

15. Select `Done`.

16. If this is the last calibration constant you will be adjusting, see "Calibration Constants" to store the calibration constants as protected data (in EEPROM).

Related Performance Tests

Self-tests

In Case of Difficulty

1. Make sure the 40 MHz reference input cable is connected while the A6 assembly is on the analog extender board.
2. For the IF gain adjustment, if the needle registers on the far left or right, ensure that all coax cables (including semi-rigid) are connected and that no unlocked message is displayed.
3. There is some interaction between the adjustments in this procedure. Try an alternate order of adjustments.
4. Refer to the *Troubleshooting* manual.

6. YO Driver +10V Reference

Description and Procedure

No test equipment is required for this procedure.

As the internal DVM monitors the +10V reference, you make the adjustment.

1. Turn the synthesizer on and press (PRESET). Let the instrument warm up for at least one hour.
2. Select the A13 adjustment menu. On the synthesizer, set:
   (SERVICE) `Adjust Menu` `AssyAdj Menu` `A13 Adj Menu`
3. Select the A13 +10V reference adjustment, `A13+10V Ref`.
4. Adjust A13R11 (see Figure 3-10) to center the "needle" on the display.

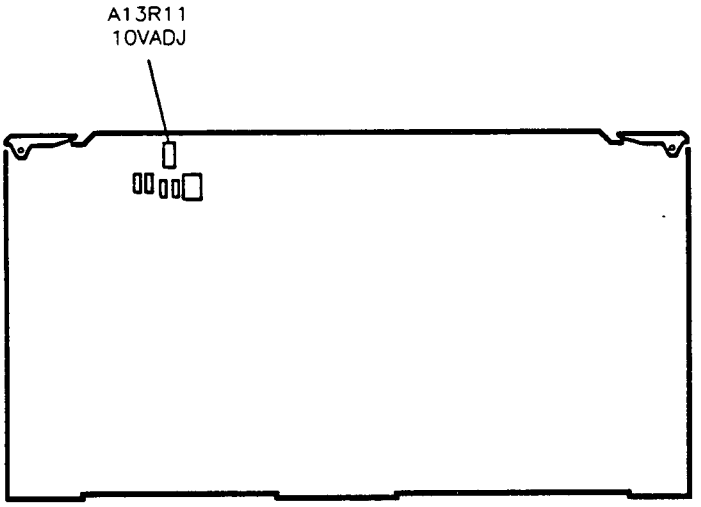


Figure 3-10. YO Driver +10V Reference Adjustment Location

5. Select `Done`.

Related Performance Tests

Self-tests

In Case of Difficulty

Refer to the *Troubleshooting* manual.

7. YO Driver Gain and Linearity

Description and Procedure

No test equipment is required for these adjustments.

For the gain adjustment, the synthesizer's internal DVM monitors the YO loop error voltage at two frequencies (points B and C in Figure 3-11). When you select the gain potentiometer adjustment, the synthesizer displays the difference in voltage between points B and C as a "needle" with arrows on either side. By adjusting A13R54 to center the "needle", you equalize the voltage between the two frequency points.

The linearity adjustment has two parts (each of which is selected and adjusted similarly to the gain adjustment). The low break point adjustment equalizes the voltage between points A and B in Figure 3-11. The high break point adjustment equalizes the voltage between points C and D.

Note: You must adjust the gain first; then adjust the break points.

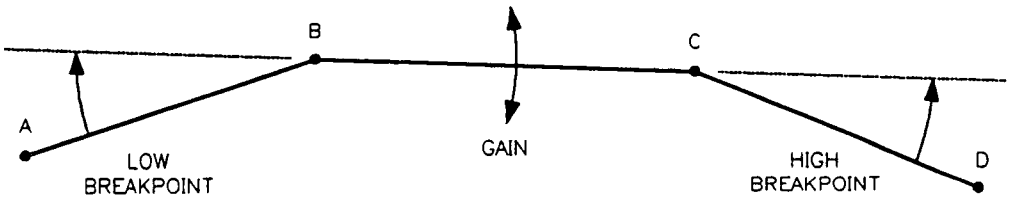


Figure 3-11. YO Gain and Linearity Break Points

1. Turn the synthesizer on and press (PRESET). Let it warm up for at least one hour.
2. Select the A13 gain menu. Press:
   (SERVICE) `Adjust Menu` `AssyAdj Menu` `A13 Adj Menu` `A13 Gain Menu`

Note: If the following message is displayed: `Adjust A13 pot until "locked".`, adjust the potentiometer until the locked indication is displayed. Continue with step 3.

3. Select the gain potentiometer adjustment, `Gain Pot`.
4. Adjust A13R54 (see Figure 3-12) to center the "needle" on the display.

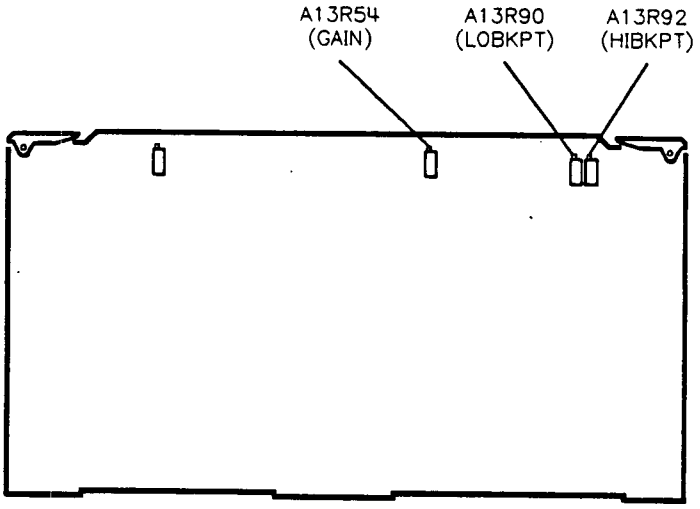


Figure 3-12. YO Gain and Linearity Adjustment Locations

5. Select the low break point potentiometer adjustment, `Lo Bk Pot`.
6. Adjust A13R90 (see Figure 3-12) to center the "needle" on the display.
7. Select the high break point potentiometer adjustment, `Hi Bk Pot`.
8. Adjust A13R92 (see Figure 3-12) to center the "needle" on the display.
9. Select `Done`.
10. If this is the last calibration constant you will be adjusting, see "Calibration Constants" to store the calibration constants as protected data (in EEPROM).

Related Performance Tests

Self-tests

In Case of Difficulty

Refer to the *Troubleshooting* manual.

8. YO Loop Gain

Description and Procedure

No test equipment is required for this procedure.

1. Turn the synthesizer on and press (PRESET). Let the instrument warm up for at least one hour.
2. Select the assembly adjustment menu. Press:
   (SERVICE) `Adjust Menu` `AssyAdj Menu`
3. Select the A5 loop gain adjustment, `A5 Loop Gain`.
4. On the A5 assembly, set all five switches on A5S1 to the closed position (see Figure 3-13).

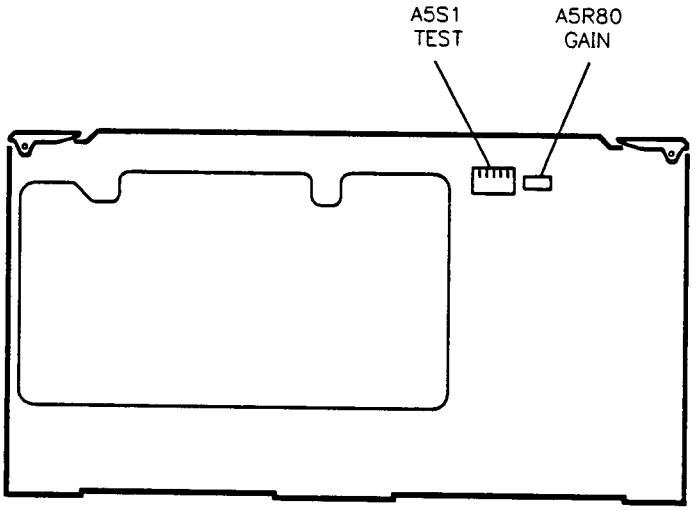


Figure 3-13. Switch and Adjustment Locations

5. Adjust A53R80 (see Figure 3-13) to center the "needle" on the display.
6. Select `Done`.
7. Set all A5 switches to open and select `Done`.

Related Performance Tests

None

In Case of Difficulty

1. Be sure to close the A5S1 switches before making the adjustment and open the switches when the adjustment is complete.
2. Refer to the *Troubleshooting* manual.

9. Amplifier/Multiplier Adjustments

Description

This procedure maximizes RF power by tracking the tuned filter in the amplifier/multiplier to the RF output frequency. The amplifier/filter output is also monitored. Initial tracking is done in single band sweeps at slow sweep speeds to eliminate the effects of bandcross and hysteresis in the tuning coil. (Those will be corrected with delay and risetime calibration constants.) A squegging clamp adjustment limits the power into the amplifier/multiplier and is adjusted in the amplifier/filter adjustments for maximum output power without squegging. A "squegg" is a distortion in the RF output caused by too much power to the amplifier/multiplier and characterized by a power dropout in a portion of the trace, or a power dropout over a broad frequency range. The SRD bias adjustments are made to optimize the efficiency of the frequency multiplication. The YTM delay compensation adjustments maximize power for fast single- and multi-band sweeps.

Note: If you have replaced either the YO, the YO driver, or the multiplier/filter driver, first initiate an auto tracking (press USER CAL `Tracking Menu` `Auto Track`.) If auto tracking passes and the instrument passes the "Maximum Leveled Power" performance test, *do not* continue with this procedure. If auto tracking fails, (an error message is displayed), continue with this procedure.

Adjustment Help

The following explanations are provided for a better understanding of the amplifier/multiplier adjustments. Refer to these explanations as often as necessary. They will help make these adjustments easier. (The adjustment procedure follows.)

Changing Synthesizer Parameters

Synthesizer parameters (frequency, power, sweep time, etc.), as well as calibration constant values are changed using the software supplied with this manual. See "Utilities" the "Automated Tests" chapter for specific information about this software.

Whenever a hardkey appears in these procedures, the software-defined "hardkey" associated with the original front panel key must be pressed. A table listing each of these keys appears in "Utilities". The following is a list of common keystrokes in these performance tests and their equivalent front panel emulator software keystrokes. (The `f1` through `f5` menukeys are equivalent to the `k1` through `k5` menukeys on the 200 series keyboards.)

Instrument	(USER CAL) `Tracking Menu` `Auto Track`
Controller	(c) `f2` `f3`
Instrument	(PRESET) (USER CAL) `Tracking Menu` `Peak RF Always`
Controller	(r) (c) `f2` `f3`
Instrument	(SERVICE) `more` `Adjust Menu` `Calib Menu` `Select Cal`
Controller	(S) `f5` `f2` `f3` `f1`
Instrument	(START) (2.0) (GHz)
Controller	(A) (2.0) (G)
Instrument	(STOP) (7) (GHz)
Controller	(o) (7) (G)

Instrument	CONT SWEEP TIME 200 msec
Controller	O T 200 k
Instrument	POWER LEVEL 25 dBm
Controller	v 25 G
Instrument	SWEEP TIME 0 msec
Controller	T 0 k
Instrument	SINGLE RF ON/OFF RF ON/OFF
Controller	I F F

Offset and Gain Adjustments

- For all offset and gain adjustments, adjust *through* the bandpass. Keep adjusting until the power peaks and then drops off. Then reset the adjustment to the peaked point.
- For all offset and gain adjustments, if power stays peaked over several calibration constant values, set the calibration constant to the middle value of the peaked range.

Adjusting to the Center of the Passband

- The amplifier/multiplier has a tracking filter on its output. Its purpose is to pass the selected RF output frequency and reject harmonics. The objective of this procedure is to track the bandpass filter with the RF output frequency over a variety of sweep conditions and frequency ranges. Since the center of the filter's passband is also where the filter has minimum power loss, all adjustments are made for maximum output power (center of the passband).

SRD Bias Adjustment

- Adjust these calibration constants *into squegging* and then back off until peak power is achieved.
- After reaching peak power, decrease power by 15 counts when adjusting the A term and decrease power by 5 counts when adjusting the B term.

Single Band Delay Compensation Adjustments

- If a drop in power greater than 1 division occurs when in single sweep, increase the A delay term to put the A term at the high end of the peak. For example, for the following calibration constant values:

  Start of the peak = 1800
  Middle of the peak = 1950
  End of the peak = 2100

  Set the A term to 2050

Setting the Fastest Sweep Time

- Setting the sweep time to 0 milliseconds sets the synthesizer to the fastest sweep time for the frequency range being swept. Each time the frequency range is changed, the sweep time must be reset to 0 ms in order to maintain the fastest sweep time.

Sweep Speed Related Adjustments

- Delay compensation adjustments are affected by sweep speed. The adjustments are performed at fast sweep speeds which are the worst case. All other adjustments are performed at slow sweep speeds; they are not affected by sweep speed.

If you have a power problem that occurs only for fast sweep rates, it is probably affected by delay compensation or risetime adjustments.

YTM Bandcross Delay Terms

- The YTM Bx Dly terms are either offset or gain terms used only during multi-band sweeps. A1 denotes the offset term for band 1. B1 denotes the gain term for band 1. The offset (A) should be adjusted to maximize power at the beginning of the band. The gain (B) is adjusted to maximize power toward the end of the band.

General Techniques

- In some adjustments power will increase and then take a large dip. Do not assume that power has already peaked. Adjust through the dip until you see

if power will begin to increase. Often the power will surpass what you first assume is the maximum.

- If the adjustment has a wide range without any apparent improvement. Leave it set to the default value.

Procedure

1. Connect the equipment as shown in Figure 3-14 using an analog oscilloscope with A versus B sweep capability. Power on all the instruments and let them warm up for at least one hour.
2. On the synthesizer, press (PRESET).

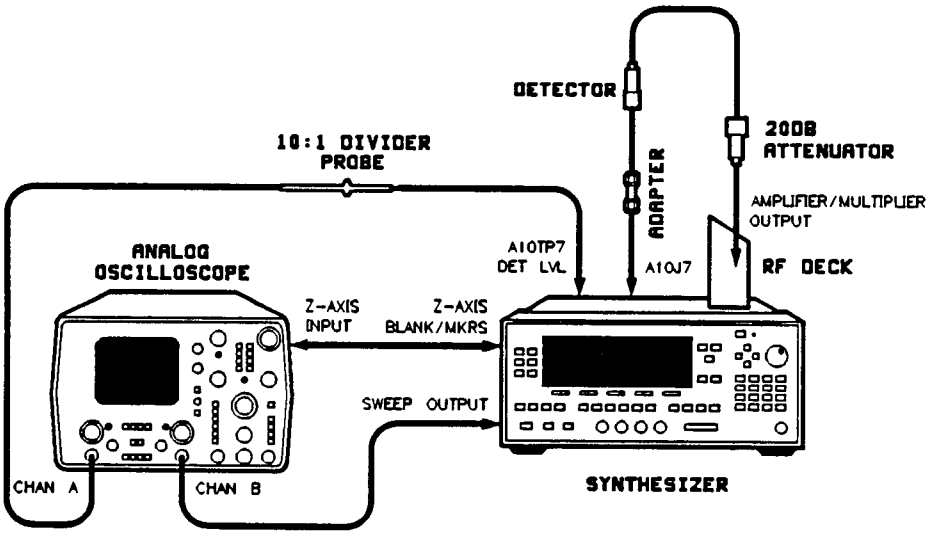


Figure 3-14. Amplifier/Multiplier Adjustments Setup

3. Set the default values given in Table 3-3 into the corresponding YTM calibration constants. On the synthesizer, set:
   (SERVICE) `Adjust Menu` `Calib Menu`

   `Select Cal` Enter the number of the first calibration constant from Table 3-3 and terminate the entry with (ENTER). When using the front panel emulator software, pressing the arrow keys will allow you to vary the

calibration constants. The calibration constant shown at the *top* of the "display" window is the active constant.

`Modify Cal` Enter the default value from Table 3-3 and terminate the entry with (ENTER).

Using the up/down arrow keys, select each of the rest of the calibration constants in Table 3-3 and set their default values by entering the value on the numeric keypad. Terminate your entry with the (ENTER) key.

Table 3-3. Calibration Constant Descriptions

Number	Description	Default Value	Adjustment Description
105	SRD Bias A; Band 1	255	Maximize power over lower 30% of band. Sweep speed is not a factor. Adjust for 0.5 dB below maximum power.
106	SRD Bias A; Band 2	60	
107	SRD Bias A; Band 3	100	
108	SRD Bias A; Band 4	100	
109	SRD Bias A; Band 5	100	
110	SRD Bias A; Band 6	100	
111	SRD Bias A; Band 7	100	
118	SRD Bias B; Band 1	255	Maximize power over higher 30% of band. Sweep speed is not a factor. Adjust for 0.5 dB below maximum power.
119	SRD Bias B; Band 2	120	
120	SRD Bias B; Band 3	120	
121	SRD Bias B; Band 4	120	
122	SRD Bias B; Band 5	120	
123	SRD Bias B; Band 6	120	
124	SRD Bias B; Band 7	120	
131	Squegg Clamp 1A	255	Default values are not altered. Numbers should remain unchanged (#131 is adjusted in another procedure).
132	Squegg Clamp 2A	255	
133	Squegg Clamp 3A	255	
134	Squegg Clamp 4A	255	
135	Squegg Clamp 5A	255	
136	Squegg Clamp 6A	255	
137	Squegg Clamp 7A	255	

Table 3-3. Calibration Constant Descriptions (continued)

Number	Description	Default Value	Adjustment Description
144	YTM Delay Term A Hrm 1	1300	Default values are not altered. Numbers should remain unchanged. Maximize power over first 20% of band. Affects fast sweeps only. Single sweep mode is also critical.
145	YTM Delay Term A Hrm 2	1400	
146	YTM Delay Term A Hrm 3	1500	
147	YTM Delay Term A Hrm 4	1800	
148	YTM Delay Term A Hrm 5	1500	
149	YTM Delay Term A Hrm 6	1500	
150	YTM Delay Term A Hrm 7	1800	
157	YTM Delay Term B Hrm 1	300	Default values are not altered. Numbers should remain unchanged. Maximize power over higher 30% of band. Affects fast sweeps only.
158	YTM Delay Term B Hrm 2	300	
159	YTM Delay Term B Hrm 3	320	
160	YTM Delay Term B Hrm 4	350	
161	YTM Delay Term B Hrm 5	320	
162	YTM Delay Term B Hrm 6	320	
163	YTM Delay Term B Hrm 7	350	
170	YTM Bx Dly Term A1	1300	Default values for all terms except A3 and A4. Delay compensation for multi-band sweeps only. Adjust for maximum power at lower 50% of band. Affects fast sweep speeds only.
171	YTM Bx Dly Term A2	1400	
172	YTM Bx Dly Term A3	1500	
173	YTM Bx Dly Term A4	1800	
174	YTM Bx Dly Term A5	1500	
175	YTM Bx Dly Term A6	1500	
176	YTM Bx Dly Term A7	1800	
183	YTM Bx Dly Term B1	300	Default values for all terms except B3 and B4. Delay compensation for multi-band sweeps only. Adjust for maximum power at lower 50% of band. Affects fast sweep speeds only.
184	YTM Bx Dly Term B2	300	
185	YTM Bx Dly Term B3	320	
186	YTM Bx Dly Term B4	350	
187	YTM Bx Dly Term B5	320	
188	YTM Bx Dly Term B6	320	
189	YTM Bx Dly Term B7	350	

Table 3-3. Calibration Constant Descriptions (continued)

Number	Description	Default Value	Adjustment Description
195	YTM Kick Threshold	110	Default values are not altered. Numbers should remain unchanged.
196	YTM CW Kick Max	6300	
197	YTM Mono Band Kick	2000	
198	YTM Stereo Band Kick	2000	
199	YTM Slew Rate	400	
200	YTM Slew Max	50	
201	YTM Slew Min	0	
202	YTM Neg Kick Wait	2	
203	YTM Fwd Kick Pct	50	
204	YTM Fwd Kick Wait	30	
205	YTM Rise; Band 1	10	Minimize power dropouts at the start of band. Adjustment is only effective at fast sweep speeds. Adjusted in the Amplifier/ Filter Adjustments.
206	YTM Rise; Band 2 A1	20	
207	YTM Rise; Band 2 B1	2	
208	YTM Rise; Band 2 A2	15	
209	YTM Rise; Band 3 A1	40	
210	YTM Rise; Band 3 B1	4	
211	YTM Rise; Band 3 A2	40	
212	YTM Rise; Band 3 B2	4	
213	YTM Rise; Band 3 A3	15	
214	YTM Rise; Band 4	50	
215	YTM Rise; Band 5	15	
216	YTM Rise; Band 6	15	
217	YTM Rise; Band 7	15	
225	*YTM Gain Band 1	2048	Maximize power over higher 10% of band. Adjust at slow sweep speeds.
226	*YTM Gain Band 2	2048	
227	*YTM Gain Band 3	2048	
228	*YTM Gain Band 4	2048	
229	*YTM Gain Band 5	2048	
230	*YTM Gain Band 6	2048	
231	*YTM Gain Band 7	2048	

Table 3-3. Calibration Constant Descriptions (continued)

Number	Description	Default Value	Adjustment Description
238	*YTM Offset Band 1	2048	Maximize power over lower 10% of band. Adjust at slow sweep speeds.
239	*YTM Offset Band 2	2048	
240	*YTM Offset Band 3	2048	
241	*YTM Offset Band 4	2048	
242	*YTM Offset Band 5	2048	
243	*YTM Offset Band 6	2048	
244	*YTM Offset Band 7	2048	
248	YTM B2 Offset Offset	0	Default values are not altered. Numbers should remain unchanged.
373	YTM Dly Term C Hrm 1	0	Default values are not altered. Numbers should remain unchanged.
374	YTM Dly Term C Hrm 2	0	
375	YTM Dly Term C Hrm 3	0	
376	YTM Dly Term C Hrm 4	0	
377	YTM Dly Term C Hrm 5	0	
378	YTM Dly Term C Hrm 6	0	
379	YTM Dly Term C Hrm 7	0	
382	YTM Bx Dly Term C1	0	Default values are not altered. Numbers should remain unchanged.
383	YTM Bx Dly Term C2	0	
384	YTM Bx Dly Term C3	0	
385	YTM Bx Dly Term C4	0	
386	YTM Bx Dly Term C5	0	
387	YTM Bx Dly Term C6	0	
525	Hibernation Time	90	Default values are not altered. Numbers should remain unchanged.
526	Bandcross 1	42	
527	Bandcross 2	32	
528	Bandcross 3	28	
529	Bandcross 4	26	
530	Bandcross 5	28	
531	Bandcross 6	20	
532	Bandcross 7	20	

YTM Gain Adjustment

Band 1 Adjustment

4. On the synthesizer, set:
   [START] [2.0] [GHz]
   [STOP] [7] [GHz]
   [SWEEP TIME] [200] [msec]
   [POWER LEVEL] [25] [dBm]

   Note that the synthesizer has unleveled output power.
5. On the oscilloscope, set:

   Channel A:

Volts/Division:	5 mV/Division
Offset:	As required
Input Coupling:	DC
Input Impedance:	1 MΩ

   Channel B

Volts/Division:	1 V/Division
Offset:	As required
Input Coupling:	DC
Input Impedance:	1 MΩ
Sweep Mode:	A versus B

   Adjust Channel B offset, volts/division, and horizontal position controls for a trace that fills the full horizontal display. Adjust the vertical position with the A vertical position control.
6. Make certain that calibration constant #131, Squegg Clamp 1A, is set to 255. Then adjust A12R69, YTMG, to maximize high end power (last two horizontal display divisions).
7. Modify calibration constant #238, YTM Offset; Band 1, to maximize low end power. To access this menu with the front panel emulator, press [S] [more] `Adjust Menu` `Calib Menu` `Select Cal`. Use the arrow keys or enter the calibration constant number and press [ENTER]. This menu is used extensively throughout the rest of this procedure.
8. Repeat steps 6 and 7 until the entire band is peaked.

9. Record the value of calibration constant #238, YTM Offset; Band 1 _____.

   Vary this calibration constant ±100 counts and verify that the power change is uniform across the entire band. If the power change is not uniform, repeat steps 6 through 8 again. Change calibration constant #238 back to its original value.

Band 2 Adjustment

10. On the synthesizer, set:
    [START] [7] [GHz]
    [STOP] [13.5] [GHz]
11. Set the oscilloscope vertical position as necessary to display the trace.
12. Modify calibration constant #226, YTM Gain; Band 2, to maximize high end power.
13. Modify calibration constant #239, YTM Offset; Band 2, to maximize low end power.
14. Adjust band 2 SRD bias calibration constants as follows:
    a. Increment calibration constant #106, SRD Bias A; Band 2, to maximize low end power. Then decrease the power by 15 counts.
    b. Increment calibration constant #119, SRD Bias B; Band 2, to maximize high end power. Then decrease the power by 5 counts.
15. Repeat steps 12 through 14 until the entire band is peaked.
16. Record the value of calibration constant #239, YTM Offset; Band 2 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. If not, repeat steps 10 through 17. Change calibration constant #239 back to its original value.

Band 3 Adjustment

17. On the synthesizer, set:
    [START] [13.5] [GHz]
    [STOP] [20] [GHz]
18. Set A12R25 B3S1 fully clockwise (see Figure 3-15).

Note: There are two sets of potentiometers on the A12 assembly with identical names. Make *certain* you are adjusting the correct ones.

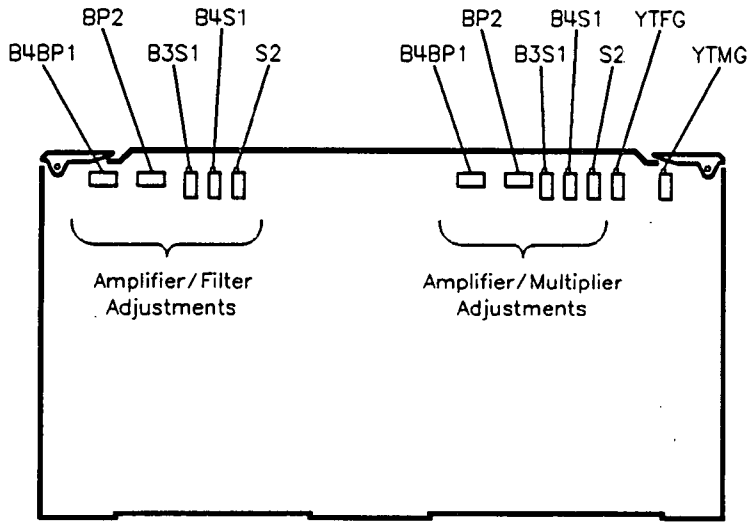


Figure 3-15. A12 Assembly Potentiometer Locations

19. Set calibration constant #227, YTM Gain; Band 3, to 2048.
20. Modify calibration constant #240, YTM Offset; Band 3, to maximize low end power.
21. Adjust A12R25 B3S1 (see Figure 3-15) for maximum power at the high end. Adjust beyond the peak for a large decrease then adjust clockwise until the power is peaked.
22. Set the band 3 SRD bias calibration constants as follows:
    a. Increment calibration constant #107, SRD Bias A; Band 3, to maximize low end power. Then decrease power by 15 counts.
    b. Increment calibration constant #120, SRD Bias B; Band 3, to maximize high end power. Then decrease power by 5 counts.
23. Repeat steps 20 through 22 until power is optimized over the full band.

Band 4 Adjustment (HP 83631A/51A only)

24. On the synthesizer, set:
    (START) (20) (GHz)
    (STOP) (26.5) (GHz)

25. See Figure 3-15 and set:
    A12R23 B4BP1 fully clockwise.
    A12R24 BP2 fully clockwise.
    A12R26 B4S1 fully clockwise.
    A12R27 S2 fully clockwise.
26. Set the oscilloscope vertical position as necessary to display the trace.
27. Modify calibration constant #241, YTM Offset; Band 4, to maximize power at the very low end.
28. Modify calibration constant #228, YTM Gain; Band 4, to maximize power at the first division on the display.

Note: If there is no noticeable increase in power in the next two adjustments, leave the potentiometers at their preset position (fully clockwise).

29. Adjust A12R26 B4S1 for maximum high-end power.
30. Adjust A12R23 B4BP1 for maximum power to optimize the 3rd through the 7th divisions. Stop when the power begins to decrease.
31. Repeat step 29.
32. Adjust band 4 SRD bias calibration constants as follows:
    a. Increment calibration constant #108, SRD Bias A; Band 4, to maximize low end power. Then decrease power by 15 counts.
    b. Increment calibration constant #121, SRD Bias B; Band 4, to maximize high end power.
33. Repeat steps 27 through 33 until the entire band is peaked.
34. Record the value of calibration constant #241, YTM Offset; Band 4 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. If not, repeat steps 25 through 34. Change calibration constant #241 back to its original value.

Band 5 Adjustment (HP 83651A only)

35. On the synthesizer, set:
    START 26.5 GHz
    STOP 33.4 GHz
36. Adjust calibration constant #229, YTM Gain; Band 5, for maximum power at the high end of band 5.

37. Modify calibration constant #242, YTM Offset; Band 5, to maximize low end power.
38. Set the band 5 SRD bias calibration constants as follows:
    a. Increment calibration constant #109, SRD Bias A; Band 5, to maximize low end power. Then decrease power by 15 counts.
    b. Increment calibration constant #122, SRD Bias B; Band 5, to maximize high end power. Then decrease power by 5 counts.
39. Repeat steps 36 through 38 until power is optimized over the full band.
40. Record the value of calibration constant #242, YTM Offset; Band 5 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. If not, repeat steps 36 through 39. Change calibration constant #242 back to its original value.

Band 6 Adjustment (HP 83651A only)

41. On the synthesizer, set:
    [START] [33.4] [GHz]
    [STOP] [38] [GHz]
42. Adjust calibration constant #230, YTM Gain; Band 6, for maximum power at the high end of band 6.
43. Modify calibration constant #243, YTM Offset; Band 6, to maximize low end power.
44. Set the band 6 SRD bias calibration constants as follows:
    a. Increment calibration constant #110, SRD Bias A; Band 6, to maximize low end power. Then decrease power by 15 counts.

       Increment calibration constant #123, SRD Bias B; Band 6, to maximize high end power. Then decrease power by 5 counts.
    b. Record the value of calibration constant #243, YTM Offset; Band 6 _____.

       Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. If not, repeat steps 41 through 44. Change calibration constant #243 back to its original value.
45. Repeat steps 41 through 43 until power is optimized over the full band.

Band 7 Adjustment (HP 83651A only)

46. On the synthesizer, set:
    START 38 GHz
    STOP 50 GHz
47. Adjust calibration constant #231, YTM Gain; Band 7, for maximum power at the high end of band 7.
48. Modify calibration constant #244, YTM Offset; Band 7, to maximize low end power.
49. Set the band 7 SRD bias calibration constants as follows:
    a. Increment calibration constant #111, SRD Bias A; Band 7, to maximize low end power. Then decrease power by 15 counts.
    b. Increment calibration constant #124, SRD Bias B; Band 7, to maximize high end power. Then decrease power by 5 counts.
    c. Repeat steps 46 through 48 until power is optimized over the full band.
50. Record the value of calibration constant #244, YTM Offset; Band 7 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. If not, repeat steps 46 through 49. Change calibration constant #244 back to its original value.

Multi-band Amplifier/Multiplier Delay Compensation

Note: Power dropouts at the start of each band are typically removed with the YTM Risetime calibration constants. These will be adjusted later.

51. On the synthesizer, set:
    START 2.0 GHz
    STOP 20 GHz
    SWEEP TIME 0 msec

Note: The synthesizer intensity marker is set to identify the bandcross frequency (13.5 GHz). Reduce oscilloscope trace intensity to identify the marker. You can also identify bandcrosses by temporarly removing the cable from the Z-AXIS BLANK/MKRS connector on the synthesizer rear panel. Make sure this cable is connected when making adjustments.

52. On the synthesizer, set:
    MARKER Marker M1 13.5 GHz (start of band 3)

53. Adjust calibration constant #172, YTM Bx Dly Term A3, to maximize power at the low end of band 3.
54. Adjust calibration constant #185, YTM Bx DLY Term B3 to maximize power at the high end of band 3.
55. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB). If the change in power is greater than 2/3 division, readjust the A term of the delay adjustment #172 for low end problems, or the B term of the delay adjustment #185 for high end problems.
56. On the synthesizer, set:
    (CONT) (SWEEP TIME) (0) (msec)
57. Press (SINGLE) several times to initiate several sweeps. If a drop in power greater than 1 division occurs when in single sweep, increase the A term of the delay adjustment #172 to put the A term at the high end of the peak (see "Adjustment Help").

Band 4 Multi-band Amplifier/Multiplier Delay Compensation (HP 83631A/51A only)

58. On the synthesizer, set:
    (START) (2.0) (GHz)
    (STOP) (26.5) (GHz)
    (CONT) (SWEEP TIME) (0) (msec)
    (MARKER) Marker M3 (20) (GHz) (start of band 4)
59. Adjust calibration constant #173, YTM Bx Dly Term A4, to maximize power at the start of band 4.
60. Adjust calibration constant #186, YTM Bx Dly Term B4, to maximize power at the high end of band 4.
61. Switch between the fastest sweep time (0 ms) and 500 ms sweep time and check that power changes less than 2/3 division (≈1 dB) across both bands. If the change is greater than 2/3 division, readjust the appropriate delay term.
62. On the synthesizer, set:
    (SWEEP TIME) (0) (msec)
63. Press (SINGLE) several times to initiate several sweeps. If a drop in power greater than 1 division occurs when in single sweep, readjust the appropriate delay term for the location of the problem.

64. On the synthesizer, set:
    [START] [15] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
65. Press [SINGLE] several times to initiate several sweeps. If a drop in power greater than 1/3 division occurs when in single sweep, readjust the appropriate delay term for the location of the problem.

Verification

66. Try the following start and stop frequencies:

Start and Stop Frequencies (GHz)

HP 83621A	HP 83631A	HP 83651A
0.045 to 20	0.045 to 26.5	0.045 to 50
4.5 to 18	4 to 23	4.5 to 33
10 to 20	10 to 20	10 to 45
2 to 14.5	2 to 14.5	2 to 23

    Compare sweeps of 0 ms and 1s and also single sweeps at fast speed. If a power drop of 0.5 division or greater is noted, readjust the appropriate calibration constant.
67. HP 83621A/31A only:

    If this is the last calibration constant you will be adjusting, see "Calibration Constants" to store the calibration constants as protected data (in EEPROM).
68. HP 83651A only:
    a. Reconnect the amplifier/multiplier output to the amplifier/filter.
    b. Install the RF deck back in the synthesizer. See "Disassembly and Replacement Procedures" as needed.
    c. Perform "Amplifier/Filter Adjustments" next.

Related Performance Tests

Maximum Leveled Power

In Case Of Difficulty

1. See "Adjustment Help" in this procedure.
2. Verify the oscilloscope ALC board calibration. When calibrated, the voltage on the oscilloscope is scaled to ≈33 mV/dB.
3. See "Troubleshooting" in the *Assembly-Level Repair* manual.

10. Amplifier/Filter Adjustments (HP 83651A only)

Description

This procedure maximizes RF power by tracking the YIG tuned filter to the RF output frequency. Initial tracking is done in single band sweeps at slow sweep speeds to eliminate the effects of bandcross and hysteresis in the tuning coil. (Those will be corrected with delay calibration constants.) Auto tracking is initiated to optimize the slow sweep tracking.

The YTF delay compensation adjustments maximize power for fast single- and multi-band sweeps. The YTM risetime adjustments are done in multi-band fast sweeps to optimize power at the start of each frequency band.

A squegging clamp adjustment limits the power and is adjusted for maximum output power without squegging. A "squegg" is a distortion in the RF output caused by too much power to the amplifier/multiplier and characterized by a power dropout in a portion of the trace, or a power dropout over a broad frequency range.

Note: If you have replaced either the YO or the YO driver, first initiate an auto tracking (press USER CAL `Tracking Menu` `Auto Track`.) If auto tracking passes and the instrument passes the "Maximum Leveled Power" performance test, *do not* continue with this procedure. If auto tracking fails, (an error message is displayed), continue with this procedure.

Adjustment Help

The following explanations are provided for a better understanding of the amplifier/filter adjustments. Refer to these explanations as often as necessary. They will help make these adjustments easier. (The adjustment procedure follows.)

Offset and Gain Adjustments

- For all offset and gain adjustments, adjust *through* the bandpass. Keep adjusting until the power peaks and then drops off. Then reset the adjustment to the peaked point.
- For all offset and gain adjustments, if power stays peaked over several calibration constant values, set the calibration constant to the middle value of the peaked range.

Squegg Clamp Calibration Constants

Squegg clamp calibration constants are available to limit the power into the amplifier/multiplier. The band 1 adjustment is set for a specific output power at the start of band 1. All other squegg clamp adjustments are set to a default value to allow maximum output power.

- When increasing any squegg clamp calibration constant, power is increased too far when any of the following occurs:
  - Any portion of the trace is distorted or power drops out in a portion of the trace (sphere squegging).
  - Power drops over a broad frequency range.
  - Power stops increasing on any portion of the trace.

Adjusting for the Center of the Passband

- The passband and tuning linearity of the amplifier/filter varies with frequency. The amplifier/filter adjustments track the amplifier/filter passband with the amplifier/multiplier output frequency over the full frequency range of the synthesizer.

Single Band Delay Compensation Adjustments

- If a drop in power greater than 1.5 dB occurs when in single sweep, increase the A delay term to put the A term at the high end of the peak. For example, for the following calibration constant values:

  Start of the peak = 1800
  Middle of the peak = 1950
  End of the peak = 2100

  Set the A term to 2050

  See Figure 3-16 for a graphic representation of the frequencies affected by the calibration constants.

Setting the Fastest Sweep Time

- Setting the sweep time to 0 milliseconds sets the synthesizer to the fastest sweep time for the frequency range being swept. Each time the frequency range is changed, the sweep time must be reset to 0 ms in order to maintain the fastest sweep time.

Sweep Speed Related Adjustments

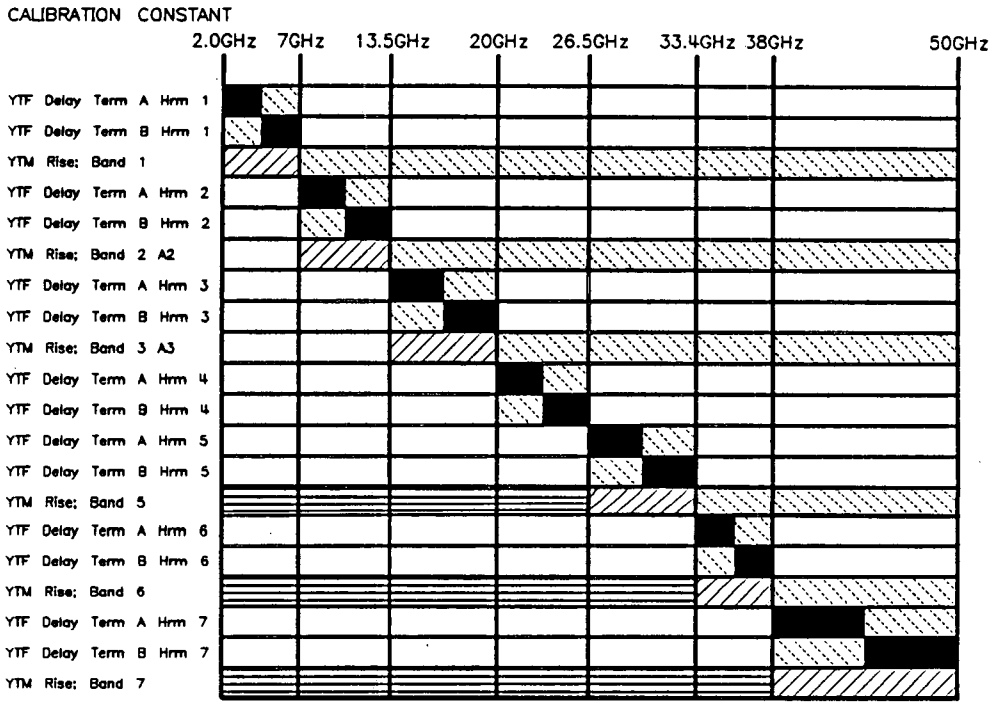
- Delay compensation and risetime adjustments are affected by sweep speed. The adjustments are performed at fast sweep speeds which are the worst case. All other adjustments are performed at slow sweep speeds; they are not affected by sweep speed.

If you have a sweep speed problem, it is probably affected by delay compensation or risetime adjustments.

YTF Bandcross Delay Terms

The YTF Bx Dly terms are either offset or gain terms. A1 denotes the offset term for band 1. B1 denotes the gain term for band 1. The offset (A) should be adjusted to maximize power at the beginning of the band. The gain (B) is adjusted to maximize power toward the end of the band.

See Figure 3-16 and Figure 3-17 for a graphic representation of the frequencies affected by the calibration constants.


CALIBRATION CONSTANT
2.0GHz
7GHz
13.5GHz
20GHz
26.5GHz
33.4GHz
38GHz
50GHz
YTF Delay Term A Hrm 1
YTF Delay Term B Hrm 1
YTM Rise: Band 1
YTF Delay Term A Hrm 2
YTF Delay Term B Hrm 2
YTM Rise: Band 2 A2
YTF Delay Term A Hrm 3
YTF Delay Term B Hrm 3
YTM Rise: Band 3 A3
YTF Delay Term A Hrm 4
YTF Delay Term B Hrm 4
YTF Delay Term A Hrm 5
YTF Delay Term B Hrm 5
YTM Rise: Band 5
YTF Delay Term A Hrm 6
YTF Delay Term B Hrm 6
YTM Rise: Band 6
YTF Delay Term A Hrm 7
YTF Delay Term B Hrm 7
YTM Rise: Band 7

Frequencies affected by calibration constant.

Start of sweep frequencies that enable calibration constants.

Risetime affects start of sweep when sweep starts in this frequency range.

Range of possible sweep.

Start fo sweep frequencies that enable calibration constants for the start of the affected band.

Example 1: YTM Rise: Band 3 B1 affects the beginning of Band 3 when the sweep starts in the second half of Band 1 and ends in Bands 3 through 7.

Example 2: YTM Rise: Band 4 affects the beginning of Band 4 when the sweep starts in Bands 1 through 3 or it affects the frequency of the start of sweep when the start of sweep is anywhere in Band 4.

Figure 3-16. Single-Band Delay and Risetime Compensation

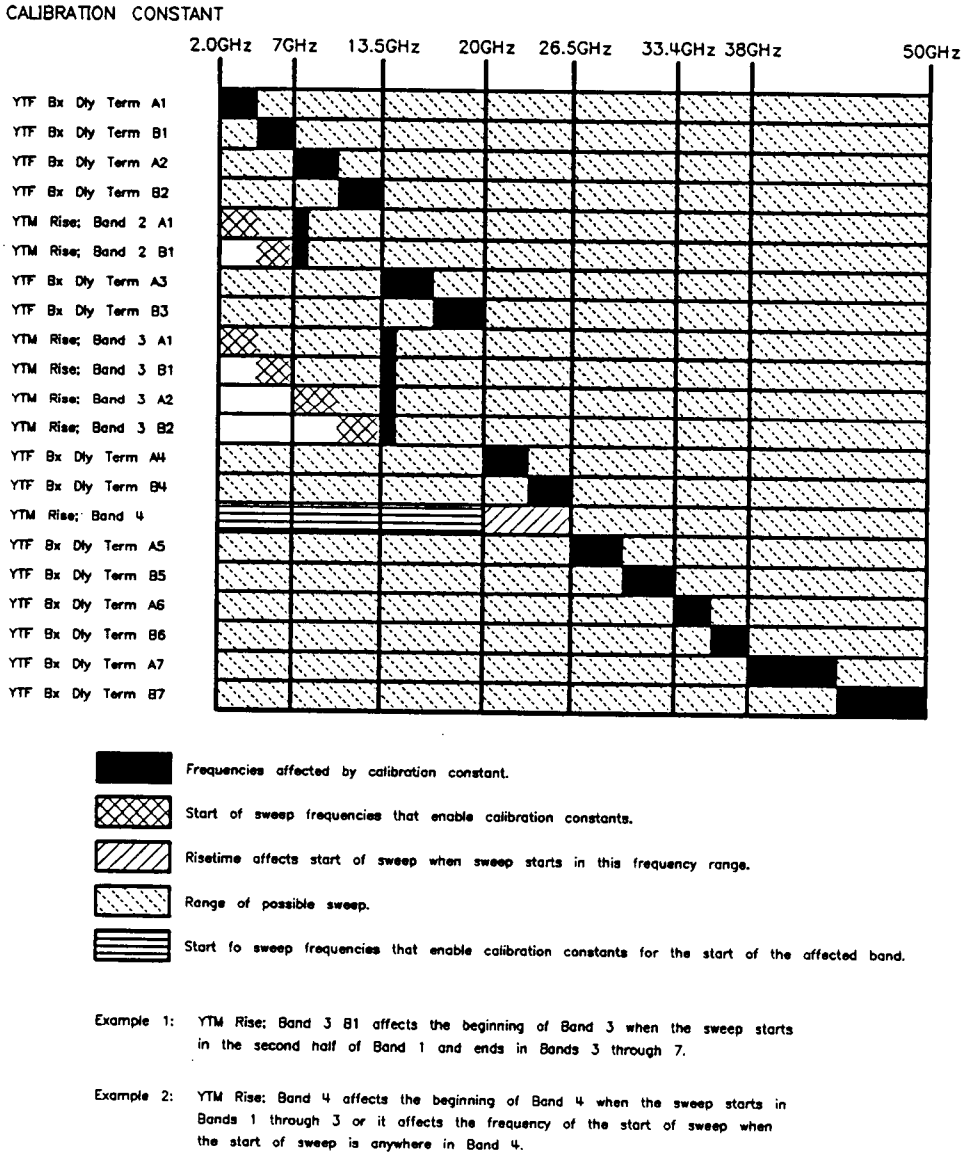

CALIBRATION CONSTANT
2.0GHz
7GHz
13.5GHz
20GHz
26.5GHz
33.4GHz
38GHz
50GHz
YTF Bx Dly Term A1
YTF Bx Dly Term B1
YTF Bx Dly Term A2
YTF Bx Dly Term B2
YTM Rise; Band 2 A1
YTM Rise; Band 2 B1
YTF Bx Dly Term A3
YTF Bx Dly Term B3
YTM Rise; Band 3 A1
YTM Rise; Band 3 B1
YTM Rise; Band 3 A2
YTM Rise; Band 3 B2
YTF Bx Dly Term A4
YTF Bx Dly Term B4
YTM Rise; Band 4
YTF Bx Dly Term A5
YTF Bx Dly Term B5
YTF Bx Dly Term A6
YTF Bx Dly Term B6
YTF Bx Dly Term A7
YTF Bx Dly Term B7
Frequencies affected by calibration constant.
Start of sweep frequencies that enable calibration constants.
Risetime affects start of sweep when sweep starts in this frequency range.
Range of possible sweep.
Start fo sweep frequencies that enable calibration constants for the start of the affected band.
Example 1: YTM Rise; Band 3 B1 affects the beginning of Band 3 when the sweep starts in the second half of Band 1 and ends in Bands 3 through 7.
Example 2: YTM Rise; Band 4 affects the beginning of Band 4 when the sweep starts in Bands 1 through 3 or it affects the frequency of the start of sweep when the start of sweep is anywhere in Band 4.

Figure 3-17. Multi-Band Delay and Risetime Compensation

Procedure

1. Connect the equipment as shown in Figure 3-18 using an analog oscilloscope with A versus B sweep capability. Do not connect the power meter yet. Power on all the instruments and let them warm up for at least one hour.
2. On the synthesizer, set:
   (PRESET) (SERVICE) `Tools Menu` `Disable Doubler` (asterisk on)
3. On the power meter:

   Zero and calibrate the power meter/sensor.
   Set the power meter to dBm mode.

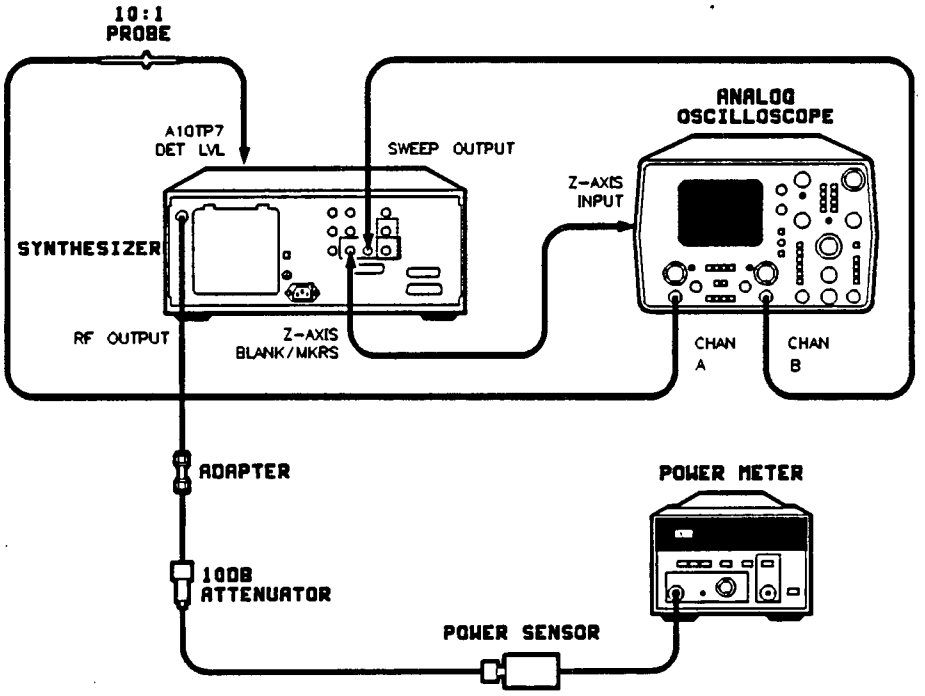


Figure 3-18. Amplifier/Filter Adjustments Setup

4. Set the default values given in Table 3-3 into the corresponding amplifier/filter calibration constants. On the synthesizer, set:
(SERVICE) `Adjust Menu` `Calib Menu`

`Select Cal` Enter the number of the first calibration constant from Table 3-3 and terminate the entry with (ENTER). When using the front panel emulator software, pressing the arrow keys will allow you to vary the calibration constants. The calibration constant shown at the *top* of the "display" window is the active constant.

`Modify Cal` Enter the default value from Table 3-3 and terminate the entry with (ENTER).

Using the up/down arrow keys, select each of the rest of the calibration constants in Table 3-3 and set their default values by entering the value on the numeric keypad. Terminate your entry with the (ENTER) key.

Table 3-3.
Amplifier/Filter Calibration Constants and Default Values

Number	Description	Default Value	Adjustment Description
131	Squegg Clamp 1A	255	Maximize power across the band without squegging. Adjusted at slow sweep speeds and single sweep mode where the SYTM shpere is most likely to squegg.
132	Squegg Clamp 2A	255	
133	Squegg Clamp 3A	255	
134	Squegg Clamp 4A	255	
135	Squegg Clamp 5A	255	
136	Squegg Clamp 6A	255	
137	Squegg Clamp 7A	255	
205	YTM Rise; Band 1	10	Minimize power dropouts at the start of band. Adjustment is only effective at fast sweep speeds.
206	YTM Rise; Band 2 A1	20	
207	YTM Rise; Band 2 B1	2	
208	YTM Rise; Band 2 A2	15	
209	YTM Rise; Band 3 A1	40	
210	YTM Rise; Band 3 B1	4	
211	YTM Rise; Band 3 A2	40	
212	YTM Rise; Band 3 B2	4	
213	YTM Rise; Band 3 A3	15	
214	YTM Rise; Band 4	50	
215	YTM Rise; Band 5	15	
216	YTM Rise; Band 6	15	
217	YTM Rise; Band 7	15	
561	YTF Delay Term A Hrm 1	1300	Maximize power over first 20% of band. Affects fast sweeps only. Single sweep mode is also critical.
562	YTF Delay Term A Hrm 2	1400	
563	YTF Delay Term A Hrm 3	1500	
564	YTF Delay Term A Hrm 4	1800	
565	YTF Delay Term A Hrm 5	1500	
566	YTF Delay Term A Hrm 6	1500	
567	YTF Delay Term A Hrm 7	1800	

Table 3-3.
Amplifier/Filter Calibration Constants and Default Values
(continued)

Number	Description	Default Value	Adjustment Description
571	YTF Delay Term B Hrm 1	300	Maximize power over higher 30% of band. Affects fast sweeps only.
572	YTF Delay Term B Hrm 2	300	
573	YTF Delay Term B Hrm 3	350	
574	YTF Delay Term B Hrm 4	350	
575	YTF Delay Term B Hrm 5	350	
576	YTF Delay Term B Hrm 6	350	
577	YTF Delay Term B Hrm 7	350	
591	YTF Bx Dly Term A1	1300	Delay compensation for multi-band sweeps only. Adjust for maximum power at lower 50% of band. Affects fast sweep speeds only.
592	YTF Bx Dly Term A2	1400	
593	YTF Bx Dly Term A3	1500	
594	YTF Bx Dly Term A4	1800	
595	YTF Bx Dly Term A5	1500	
596	YTF Bx Dly Term A6	1500	
597	YTF Bx Dly Term A7	1800	
601	YTF Bx Dly Term B1	300	Delay compensation for multi-band sweeps only. Adjust for maximum power at higher 30% of band. Affects fast sweep speeds only.
602	YTF Bx Dly Term B2	300	
603	YTF Bx Dly Term B3	300	
604	YTF Bx Dly Term B4	350	
605	YTF Bx Dly Term B5	350	
606	YTF Bx Dly Term B6	350	
607	YTF Bx Dly Term B7	350	
621	*YTF Gain Band 1	2048	Maximize power over higher 10% of band. Adjust at slow sweep speeds.
622	*YTF Gain Band 2	2048	
623	*YTF Gain Band 3	2048	
624	*YTF Gain Band 4	2048	
625	*YTF Gain Band 5	2048	
626	*YTF Gain Band 6	2048	
627	*YTF Gain Band 7	2048	

Table 3-3.
Amplifier/Filter Calibration Constants and Default Values
(continued)

Number	Description	Default Value	Adjustment Description
631	*YTF Offset Band 1	2048	Maximize power over lower 10% of band. Adjust at slow sweep speeds.
632	*YTF Offset Band 2	2048	
633	*YTF Offset Band 3	2048	
634	*YTF Offset Band 4	2048	
635	*YTF Offset Band 5	2048	
636	*YTF Offset Band 6	2048	
637	*YTF Offset Band 7	2048	

Amplifier/Filter Offset and Gain Adjustment

Band 1 Adjustment

5. On the synthesizer, set:
   [START] [2.0] [GHz]
   [STOP] [7] [GHz]
   [SWEEP TIME] [200] [msec]
   [POWER LEVEL] [25] [dBm]

   Note that the synthesizer has unleveled output power.

6. On the oscilloscope, set:

Channel A:

Volts/Division:	5 mV/Division
Offset:	As required
Input Coupling:	DC
Input Impedance:	1 MΩ

Channel B

Volts/Division:	1 V/Division
Offset:	As required
Input Coupling:	DC
Input Impedance:	1 MΩ
Sweep Mode:	A versus B

Adjust Channel A offset, volts/division, and horizontal position controls for a trace that fills the full horizontal display. Adjust the vertical position with the A vertical position control.

Note: In the following adjustment power dropouts may occur due to squegging. Ignore the squegging (the squegg clamp will be adjusted later) and peak the adjustment for maximum power.

7. Adjust A12R126 YTFG to maximize high end power (last two horizontal display divisions).
8. Modify calibration constant #631, YTF Offset; Band 1, to maximize low end power.
9. Repeat steps 7 and 8 until the entire band is peaked.
10. Record the value of calibration constant #631, YTF Offset; Band 1 _____.

Vary this calibration constant ±100 counts and verify that the power change is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If the power change is not uniform, repeat steps 7 through 10 until it is. Then change calibration constant #631 back to the recorded value.

Band 2 Adjustment

11. On the synthesizer, set:
    START 7 GHz
    STOP 13.5 GHz
12. Set the oscilloscope vertical position as necessary to display the trace.
13. Modify calibration constant #622, YTF Gain; Band 2, to maximize high end power.
14. Modify calibration constant #632, YTF Offset; Band 2, to maximize low end power.
15. Repeat steps 13 and 14 until the entire band is peaked.
16. Record the value of calibration constant #632, YTF Offset; Band 2 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If not, repeat steps 13 through 16 until it is. Then change calibration constant #632 back to the recorded value.

Band 3 Adjustment

17. On the synthesizer, set:
    START 13.5 GHz
    STOP 20 GHz
18. Set A12R108 B3S1 fully clockwise (see Figure 3-19).

    Note: There are two sets of potentiometers on the A12 assembly with identical names. Make *certain* you are adjusting the correct ones.

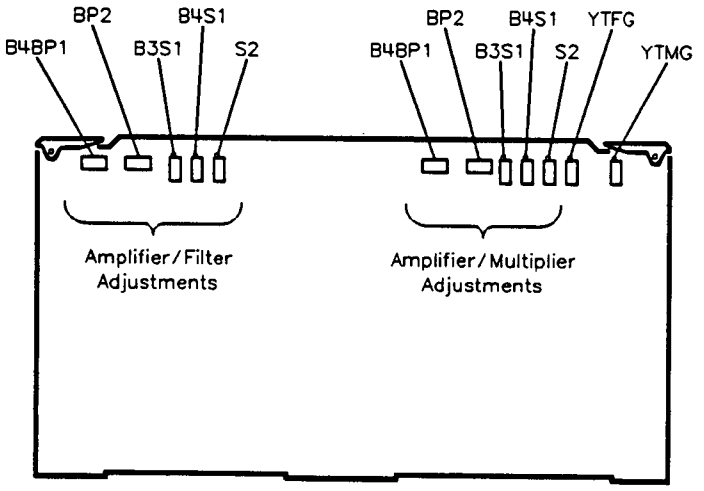


Figure 3-19. A12 Assembly Potentiometer Locations

19. Set calibration constant #623, YTF Gain; Band 3, to 2084.
20. Modify calibration constant #633, YTF Offset; Band 3, to maximize low end power.
21. Adjust A12R108 B3S1 (see Figure 3-19) for maximum power over the rest of the sweep (3 to 10 divisions).
22. Repeat steps 20 and 21 until power is optimized over the full band.
23. Record the value of calibration constant #633, YTF Offset; Band 3 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If not, repeat steps 18 through 23 until it is. Then change calibration constant #633 back to the recorded value.

Band 4 Adjustment

24. On the synthesizer, set:
    (START) (20) (GHz)
    (STOP) (26.5) (GHz)
25. Set the following potentiometers, located on the left side of the board, fully clockwise:

A12R109 B4S1
A12R110 S2
A12R105 B4BP1
A12R106 BP2

26. Set the oscilloscope vertical position as necessary to display the trace.
27. Modify calibration constant #634, YTF Offset; Band 4, to maximize low end power.
28. Modify calibration constant #624, YTF Gain; Band 4, to maximize power at the first division on the display.

Note: If there is no noticeable increase in power in the next two adjustments, leave the potentiometers at their preset position (fully clockwise).

29. Adjust A12R109 B4S1 for maximum high-end power.
30. Adjust A12R105 B4BP1 for maximum power to optimize the 3rd through the 7th divisions. Stop when the power begins to decrease.
31. Repeat step 29.
32. Repeat steps 27 through 30 until the entire band is peaked.
33. Record the value of calibration constant #634, YTM Offset; Band 4 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If not, repeat steps 27 through 33 until it is. Then change calibration constant #634 back to the recorded value.

Band 5 Adjustment

34. On the synthesizer set:
    [START] [26.5] [GHz]
    [STOP] [33.4] [GHz]
35. Set the oscilloscope vertical position as necessary to display the trace.
36. Modify calibration constant #625, YTF Gain; Band 5, to maximize high end power.
37. Modify calibration constant #635, YTF Offset; Band 5, to maximize low end power.
38. Repeat steps 36 through 37 until the entire band is peaked.
39. Note the value of calibration constant #635, YTF Offset; Band 5 _____.

Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If not, repeat steps 36 through 39 until it is. Then change calibration constant #635 back to the recorded value.

Band 6 Adjustment

40. On the synthesizer set:
    [START] [33.4] [GHz]
    [STOP] [38] [GHz]
41. Set the oscilloscope vertical position as necessary to display the trace.
42. Modify calibration constant #626, YTF Gain; Band 6, to maximize high end power.
43. Modify calibration constant #636, YTF Offset; Band 6, to maximize low end power.
44. Repeat steps 42 through 43 until the entire band is peaked.
45. Note the value of calibration constant #636, YTF Offset; Band 6 _____.

    Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If not, repeat steps 41 through 45 until it is. Then change calibration constant #636 back to the recorded value.

Band 7 Adjustment

46. On the synthesizer set:
    [START] [38] [GHz]
    [STOP] [50] [GHz]
47. Set the oscilloscope vertical position as necessary to display the trace.
48. Modify calibration constant #627, YTF Gain; Band 7, to maximize high end power.
49. Modify calibration constant #637, YTF Offset; Band 7, to maximize low end power.
50. Repeat steps 48 through 49 until the entire band is peaked.
51. Note the value of calibration constant #637, YTF Offset; Band 7 _____.

Vary this calibration constant ±100 counts and verify that the power change on the analyzer is uniform across the entire band. (Look for a difference of several divisions or a power dropout.) If not, repeat steps 47 through 51 until it is. Then change calibration constant #637 back to the recorded value.

Auto Tracking Verification

52. Record the value of the following calibration constants:

#621 YTF Gain; Band 1 _____
#622 YTF Gain; Band 2 _____
#623 YTF Gain; Band 3 _____
#624 YTF Gain; Band 4 _____
#625 YTF Gain; Band 5 _____
#626 YTF Gain; Band 6 _____
#627 YTF Gain; Band 7 _____

#631 YTF Offset; Band 1 _____
#632 YTF Offset; Band 2 _____
#633 YTF Offset; Band 3 _____
#634 YTF Offset; Band 4 _____
#635 YTF Offset; Band 5 _____
#636 YTF Offset; Band 6 _____
#637 YTF Offset; Band 7 _____

#225 YTM Gain; Band 1 _____
#226 YTM Gain; Band 2 _____
#227 YTM Gain; Band 3 _____
#228 YTM Gain; Band 4 _____
#229 YTM Gain; Band 5 _____
#230 YTM Gain; Band 6 _____
#231 YTM Gain; Band 7 _____

#238 YTM Offset; Band 1 _____
#239 YTM Offset; Band 2 _____
#240 YTM Offset; Band 3 _____
#241 YTM Offset; Band 4 _____
#242 YTM Offset; Band 5 _____
#243 YTM Offset; Band 6 _____

#244 YTM Offset; Band 7 _____

53. Initiate auto tracking on the synthesizer as follows. Terminate the RF OUTPUT with a good 50Ω impedance match such as a 10 dB attenuator or a power sensor. Press:
[USER CAL] Tracking Menu Auto Track

Wait for the synthesizer to complete auto tracking. If auto tracking fails (an error message is displayed) repeat the gain and offset adjustments for the failed frequency.

54. On the synthesizer, set:
[START] [2.0] [GHz]
[STOP] [20] [GHz]
[CONT] [SWEEP TIME] [1.5] [sec]
[POWER LEVEL] [25] [dBm]
[SERVICE] Tools Menu Disable Doubler (asterisk off)

Connect the power meter to the synthesizer RF OUTPUT through the power sensor and 10 dB attenuator (see Figure 3-18). Adjust the oscilloscope horizontal control to place the low power point on a vertical graticule and note the position.

Select manual sweep. Press SWEEP [MENU] Manual Sweep (asterisk on). Use the arrow keys to adjust the CW frequency to the minimum power point on the oscilloscope.

On the power meter, check that the power at this point is not less than the specified maximum leveled power (note that power is attenuated by 10 dB). If it is, note the level and frequency, and check the following:

a. Compare the manually adjusted YTF and YTM gain and offset calibration constants (step 52) to the auto tracked calibration constants. A large difference in values (several hundred counts) indicates a possible misadjustment. The auto tracking values are correct.
b. If the band 3 values are within 500 counts of the limits of their ranges, repeat the B3S1, B4S1, and B4BP1 adjustments with the doubler disabled.
c. If the band 4 values are within 500 counts of the limits of the range, repeat the B4S1 and B4BP1 adjustments with the doubler disabled (unless you have just readjusted these adjustments in step b).

d. If the problem continues, it is most likely hardware-related. Refer to the *Troubleshooting* manual.

55. For the HP 83631A/51A, repeat step 54 for each frequency range listed in Table 3-4 and a sweep time of 1.5 seconds.

Table 3-4. Frequency Ranges

HP 83631A	HP 83651A
20 – 26.5 GHz	20 – 26.5 GHz
	26.5 – 40 GHz
	40 – 50 GHz

56. On the synthesizer, set:
    START 2.0 GHz
    STOP 20 GHz
    CONT SWEEP TIME 1.5 sec
57. Set the synthesizer power level to the specified maximum leveled power. Check for ALC oscillations or level squegging.
    a. The SRD bias A or B calibration constants for the affected band might eliminate oscillation. The problem is with the A term if the oscillations are near the beginning of the band. It is with the B term if the oscillations are near the end of the band. SRD bias has a range. It can be overbiased which causes level squegging. If so, decrease the value of the SRD bias calibration constants and repeat the adjustment.
    b. If the SRD bias calibration constants have no effect, check the ALC Mod Gain calibration constant for the appropriate band.
58. For the HP 83631A/51A, repeat step 57 for each frequency range listed in Table 3-4 and a sweep time of 1.5 seconds.
59. Set the synthesizer power level to 25 dBm and then set various frequency ranges such as 5 GHz to 50 GHz or 10 GHz to 45 GHz.

    Set the sweep times to greater than 200 ms for single-band sweeps and less than 1.5 seconds for multi-band sweeps since delay compensation has not yet been adjusted.

    For each frequency range set, compare the signal levels of single sweep to continuous sweep. Band frequency ranges are as follows:

Band	Frequency Range (GHz)
0	0.01 to < 2.0
1	2.0 to 7.0
2	7.0 to < 13.5
3	13.5 to 20.0
4	> 20.0 to 26.5
5	≥ 26.5 to < 33.4
6	≥ 33.4 to < 38
7	≥ 38 to 50

Problems here are typically associated with sphere heating while awaiting the start of sweep trigger. If necessary adjust the squegging clamp calibration constant for the appropriate band.

Single-Band Amplifier/Filter Delay

60. On the synthesizer, set:
    [START] [2.0] [GHz]
    [STOP] [7] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
    [POWER LEVEL] [25] [dBm]
    [SERVICE] `Tools Menu` `Disable Doubler` (asterisk on)

    The synthesizer will have unleveled output power.

Note: The oscilloscope vertical sensitivity is initially set to 50 mV/division (5 mV/division with a 10:1 probe) providing a logarithmic scale of ≈1.5 dB/division. If necessary, decrease the vertical sensitivity for some frequency bands to 100 mV/division in order to display the entire trace on the CRT. If you do change the vertical sensitivity by half, remember that the logarithmic scale must change by half also.

Band 1 Adjustment

61. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB.) If not, adjust

the appropriate rise or delay term (steps 64 through 66) and repeat this step.

Note: If fast sweep has more power than slow sweep do not readjust. Continue with the next step.

62. On the synthesizer, set:
    [SWEEP TIME] [0] [msec]
63. Press [SINGLE] several times to initiate several sweeps and check that a drop in power $\leq$ 1 division occurs when in single sweep. If it is less than 1 division, skip the remainder of "Band 1 Adjustment" and continue with "Band 2 Adjustment".

    If the drop in power is $>$ 1 division, increase the A term of the delay adjustment #561 to put the A term at the high end of the peak. Then repeat from step 61.
64. Adjust calibration constant #561, YTF Dly Term A Hrm 1, to maximize power for the low end of band 1. Set the calibration constant for the middle of the peaked range.
65. Adjust calibration constant #571, YTF Dly Term B Hrm 1, to maximize power for the high end of band 1. Set the calibration constant for the middle of the peaked range.
66. Adjust calibration constant #205, YTM Rise; Band 1, to minimize power dropout at the start of band 1.

Band 2 Adjustment

Note: If the oscilloscope is not already set to 5 mV/division, do so now (the logarithmic scale is calculated with this value).

67. On the synthesizer, set:
    [START] [7] [GHz]
    [STOP] [13.5] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
68. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than $\approx$2/3 division. If not, adjust the appropriate rise or delay term (steps 71 through 73) and then repeat this step.
69. On the synthesizer, set:
    [SWEEP TIME] [0] [msec]
70.

a. Press [SINGLE] several times to initiate several sweeps. Note any drop in power.

b. Press [SINGLE] [RF ON/OFF]. Then press [RF ON/OFF] again (LED on) and note any drop in power.

c. The power loss noted in step a can be no smaller than the power loss noted in step b. If the step a power loss is greater than the step b power loss by 1 division (≈1.5 dB), increase the A term of the delay adjustment #562 to put the A term at the high end of the peak. Then repeat from step 68.

If the power loss in step a is *not* smaller than that in step b, skip the rest of "Band 2 Adjustment" and continue with "Band 3 Adjustment".

71. Adjust calibration constant #562, YTF Dly Term A Hrm 2, to maximize power for the low end of band 2.
72. Adjust calibration constant #572, YTF Dly Term B Hrm 2, to maximize power for the high end of band 2.
73. Adjust calibration constant #208, YTM Rise; Band 2 A2, to minimize power dropout at the start of band 2.

Band 3 Adjustment

74. On the synthesizer, set:
[START] [13.5] [GHz]
[STOP] [20] [GHz]
[CONT] [SWEEP TIME] [0] [msec]
75. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB). If not, adjust the appropriate rise or delay terms (steps 78 through 80) and then repeat this step.
76. On the synthesizer, set:
[SWEEP TIME] [0] [msec]
77. a. Press [SINGLE] several times to initiate several sweeps. Note any drop in power.

b. Press [SINGLE] [RF ON/OFF]. Then press [RF ON/OFF] again (LED on) and note any drop in power.

c. The power loss noted in step a can be no smaller than the power loss noted in step b. If the step a power loss is greater than the step b power loss by 1 division (≈1.5 dB), increase the A term of the delay

adjustment #573 to put the A term at the high end of the peak. Then repeat from step 75.

If the power loss in step a is *not* smaller than that in step b, skip the rest of "Band 3 Adjustment" and continue with "Band 4 Adjustment".

78. Adjust calibration constant #563, YTF Dly Term A Hrm 3, to maximize power for the low end of band 3.
79. Adjust calibration constant #573, YTF Dly Term B Hrm 3, to maximize power for the high end of band 3.
80. Adjust calibration constant #213, YTM Rise; Band 3 A3, to minimize power dropout at the start of band 3.

Band 4 Adjustment

81. On the synthesizer, set:
    [START] [20] [GHz]
    [STOP] [26.5] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
82. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than ≈2/3 division. If not, adjust the appropriate rise term (steps 85 and 86) and then repeat this step.
83. On the synthesizer, set:
    [SWEEP TIME] [0] [msec]
84. a. Press [SINGLE] several times to initiate several sweeps. Note any drop in power.
    b. Press [SINGLE] [RF ON/OFF]. Then press [RF ON/OFF] again (LED on) and note any drop in power.
    c. The power loss noted in step a can be no smaller than the power loss noted in step b. If the step a power loss is greater than the step b power loss by 1 division (≈1.5 dB), increase the A term of the delay adjustment #564 to put the A term at the high end of the peak. Then repeat from step 82.

    If the power loss in step a is *not* smaller than that in step b, skip the rest of "Band 4 Adjustment" and continue with "Band 5 Adjustment".
85. Adjust calibration constant #564, YTF Dly Term A Hrm 4, to maximize power for the low end of band 4.
86. Adjust calibration constant #574, YTF Dly Term B Hrm 4, to maximize power for the high end of band 4.

Band 5 Adjustment

87. On the synthesizer, set:
    [START] [26.5] [GHz]
    [STOP] [33.4] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
88. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB). If not, adjust the appropriate rise or delay term (steps 91 through 93) and then repeat this step.
89. On the synthesizer, set:
    [SWEEP TIME] [0] [msec]
90. a. Press [SINGLE] several times to initiate several sweeps. Note any drop in power.
    b. Press [SINGLE] [RF ON/OFF]. Then press [RF ON/OFF] again (LED on) and note any drop in power.
    c. The power loss noted in step a can be no smaller than the power loss noted in step b. If the step a power loss is greater than the step b power loss by 1 division (≈1.5 dB), increase the A term of the delay adjustment #565 to put the A term at the high end of the peak. Then repeat from step 88.

    If the power loss in step a is *not* smaller than that in step b, skip the rest of "Band 5 Adjustment" and continue with "Band 6 Adjustment".
91. Adjust calibration constant #565, YTF Dly Term A Hrm 5, to maximize power for the low end of band 5.
92. Adjust calibration constant #575, YTF Dly Term B Hrm 5, to maximize power for the high end of band 5.
93. Adjust calibration constant #215, YTM Rise; Band 5, to minimize power dropout at the start of band 5.

Band 6 Adjustment

94. On the synthesizer, set:
    [START] [33.4] [GHz]
    [STOP] [38] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
95. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB). If not, adjust

the appropriate rise or delay term (steps 98 through 100) and then repeat this step.

96. On the synthesizer, set:
    [SWEEP TIME] [0] [msec]
97. a. Press [SINGLE] several times to initiate several sweeps. Note any drop in power.
    b. Press [SINGLE] [RF ON/OFF]. Then press [RF ON/OFF] again (LED on) and note any drop in power.
    c. The power loss noted in step a can be no smaller than the power loss noted in step b. If the step a power loss is greater than the step b power loss by 1 division (≈1.5 dB), increase the A term of the delay adjustment #566 to put the A term at the high end of the peak. Then repeat from step 95.

    If the power loss in step a is *not* smaller than that in step b, skip the rest of "Band 6 Adjustment" and continue with "Band 7 Adjustment".
98. Adjust calibration constant #566, YTF Dly Term A Hrm 6, to maximize power for the low end of band 6.
99. Adjust calibration constant #576, YTF Dly Term B Hrm 6, to maximize power for the high end of band 6.
100. Adjust calibration constant #216, YTM Rise; Band 6, to minimize power dropout at the start of band 6.

Band 7 Adjustment

101. On the synthesizer, set:
    [START] [38] [GHz]
    [STOP] [50] [GHz]
    [CONT] [SWEEP TIME] [0] [msec]
102. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB). If not, adjust the appropriate rise or delay term (steps 105 through 107) and then repeat this step.
103. On the synthesizer, set:
    [SWEEP TIME] [0] [msec]
104. a. Press [SINGLE] several times to initiate several sweeps. Note any drop in power.
    b. Press [SINGLE] [RF ON/OFF]. Then press [RF ON/OFF] again (LED on) and note any drop in power.

c. The power loss noted in step a can be no smaller than the power loss noted in step b. If the step a power loss is greater than the step b power loss by 1 division (≈1.5 dB), increase the A term of the delay adjustment #567 to put the A term at the high end of the peak. Then repeat from step 102.

   If the power loss in step a is *not* smaller than that in step b, skip the rest of "Band 7 Adjustment" and continue with "Multi-band YTF Delay".

105. Adjust calibration constant #567, YTF Dly Term A Hrm 7, to maximize power for the low end of band 7.
106. Adjust calibration constant #577, YTF Dly Term B Hrm 7, to maximize power for the high end of band 7.
107. Adjust calibration constant #217, YTM Rise; Band 7, to minimize power dropout at the start of band 7.

Multi-band YTF Delay

108. On the synthesizer, set:
   START 13 GHz
   STOP 20 GHz
   CONT SWEEP TIME 0 msec
   POWER LEVEL 25 dBm

Note: Synthesizer intensity markers are set to identify the bandcross frequencies (7.0, 13.5 GHz, and 20.0 GHz). Reduce oscilloscope trace intensity to identify these markers. You can also identify bandcrosses by temporarly removing the cable from the Z-AXIS BLANK/MKRS connector on the synthesizer rear panel. Make sure this cable is connected when making adjustments.

109. On the synthesizer, set:
   MARKER Marker M1 13.5 GHz (asterisk on)
110. Adjust calibration constant #593, YTF Bx Dly Term A3, to maximize power at the low end of band 3.
111. Adjust calibration constant #603, YTF Bx DLY Term B3 to maximize power at the high end of band 3.
112. Adjust calibration constant #212, YTM Rise; Band 3 B2, to minimize power dropout at the end of band 3.

113. Switch between the fastest sweep time (0 ms) and 200 ms sweep time and check that power changes less than 2/3 division (≈1 dB). If the change in power is greater than 2/3 division, readjust the A term of the delay adjustment #593 for low end problems, or the B term of the delay adjustment #603 for high end problems.
114. On the synthesizer, set:
[CONT] [SWEEP TIME] [0] [msec]
115. Press [SINGLE] several times to initiate several sweeps. If a drop in power greater than 1 division occurs when in single sweep, increase the A term of the delay adjustment #593 to put the A term at the high end of the peak.
116. On the synthesizer, set:
[START] [7] [GHz]
[CONT] [SWEEP TIME] [0] [msec]
117. Switch between the fastest sweep time (0 ms) and 500 ms sweep time and check that power changes less than 2/3 division (≈1 dB) across both bands. If the change is greater than 2/3 division, readjust the appropriate delay term.
118. Adjust calibration constant #592, YTF Bx Dly Term A2, to maximize power at the start of band 2 (start of sweep).
119. Adjust calibration constant #602, YTF Bx Dly Term B2, to maximize power at the end of band 2.
120. Adjust calibration constant #211, YTM Rise; Band 3 A2, to minimize power dropout at the start of band 3.
121. On the synthesizer, set:
[10] [GHz]
122. Adjust calibration constant #212, YTM Rise; Band 3 B2, to minimize power dropout at the start of band 3.
123. On the synthesizer, set:
[SWEEP TIME] [0] [msec]
124. Press [SINGLE] several times to initiate several sweeps. If a drop in power greater than 1 division occurs when in single sweep, readjust the appropriate delay term for the location of the problem.
125. On the synthesizer, set:
[START] [2.0] [GHz]
[CONT] [SWEEP TIME] [0] [msec]
[MARKER] Marker M2 [7] [GHz] (asterisk on)

126. Adjust calibration constant #591, YTF Bx Dly Term A1, to maximize power at the start of band 1.
127. Adjust calibration constant #601, YTF Bx Dly Term B1, to maximize power at the high end of band 1.
128. Adjust calibration constant #206, YTM Rise; Band 2 A1, to minimize power dropout at the start of band 2.
129. Adjust calibration constant #209, YTM Rise; Band 3 A1, to minimize power dropout at the start of band 3.
130. Switch between the fastest sweep time (0 ms) and 1s sweep time and check that power changes less than 2/3 division (≈1 dB) across all bands. If the change is greater than 2/3 division, readjust the appropriate delay term.
131. On the synthesizer, set:
[SWEEP TIME] [0] [msec]
132. Press [SINGLE] several times to initiate several sweeps. If a drop in power greater than 1 division occurs when in single sweep, readjust the appropriate delay or risetime term for the location of the problem.
133. On the synthesizer, set:
[START] [5] [GHz]
134. Adjust calibration constant #210, YTM Rise; Band 3 B1, to minimize power dropout at the end of band 3.
135. Adjust calibration constant #207, YTM Rise; Band 2 B1, to minimize power dropout at the end of band 2.

Band 4 Multi-band YTF Delay

136. On the synthesizer, set:
[START] [2.0] [GHz]
[STOP] [26.5] [GHz]
[CONT] [SWEEP TIME] [0] [msec]
[MARKER] Marker M3 [20] [GHz] (asterisk on)
137. Adjust calibration constant #594, YTF Bx Dly Term A4, to maximize power at the start of band 4.
138. Adjust calibration constant #604, YTF Bx Dly Term B4, to maximize power at the end of band 4.
139. Adjust calibration constant #214, YTM Rise; Band 4, to minimize power dropout at the start of band 4.

140. Switch between the fastest sweep time (0 ms) and 500 ms sweep time and check that power changes less than 2/3 division (≈1 dB) across both bands. If the change is greater than 2/3 division, readjust the appropriate delay term.
141. On the synthesizer, set:
[SWEEP TIME] [0] [msec]
142. Press [SINGLE] several times to initiate several sweeps. If a drop in power greater than 1 division occurs when in single sweep, readjust the appropriate delay term for the location of the problem.
143. On the synthesizer, set:
[START] [15] [GHz]
[CONT] [SWEEP TIME] [0] [msec]
144. Press [SINGLE] several times to initiate several sweeps. If a drop in power greater than 1/3 division occurs when in single sweep, readjust the appropriate delay or risetime term for the location of the problem.

Band 1 Squegg Clamp

145. On the synthesizer, set:
[START] [2.0] [GHz]
[STOP] [7] [GHz]
Manual Sweep [2.0] [GHz]
[POWER LEVEL] [25] [dBm]
[SERVICE] Tools Menu Disable Doubler (asterisk off)
146. Connect the power meter through a 10 dB attenuator to the synthesizer RF OUTPUT.
147. Adjust calibration constant #131, Squegg Clamp 1A, for an RF output power of +15 dBm as measured by the power meter (note that there is 10 dB of attenuation in the setup).
148. Select Cont and verify on the oscilloscope that there is no squegging.
149. Try the following start and stop frequencies:
0.045 to 50 GHz
4.5 to 33 GHz
10 to 45 GHz
2 to 23 GHz

Compare sweeps of 0 ms and 1 s and also single sweeps at fast speed. If a power drop of 0.5 division or greater is noted, readjust the appropriate calibration constant.

150. If this is the last calibration constant you will be adjusting, see "Calibration Constants" to store the calibration constants as protected data (in EEPROM).

Related Performance Tests

Maximum Leveled Power

In Case Of Difficulty

1. See "Adjustment Help" in this procedure.
2. Verify the oscilloscope ALC board calibration. When calibrated, the voltage on the oscilloscope is scaled to ≈33 mV/dB.
3. See "Troubleshooting" in the *Assembly-Level Repair* manual.

11. Low Power SRD Bias

Description and Procedure

The synthesizer is set up for a low power, 2 to 20 GHz sweep. The oscilloscope is used to monitor the ALC assembly integrator level signal while the synthesizer is forward sweeping in bands 2 and 3. Then the A9 pulse board MIN adjustment is made to minimize the integrator level signal for both bands.

1. Connect the equipment as shown in Figure 3-20. Preset all instruments and let them warm up for at least one hour.

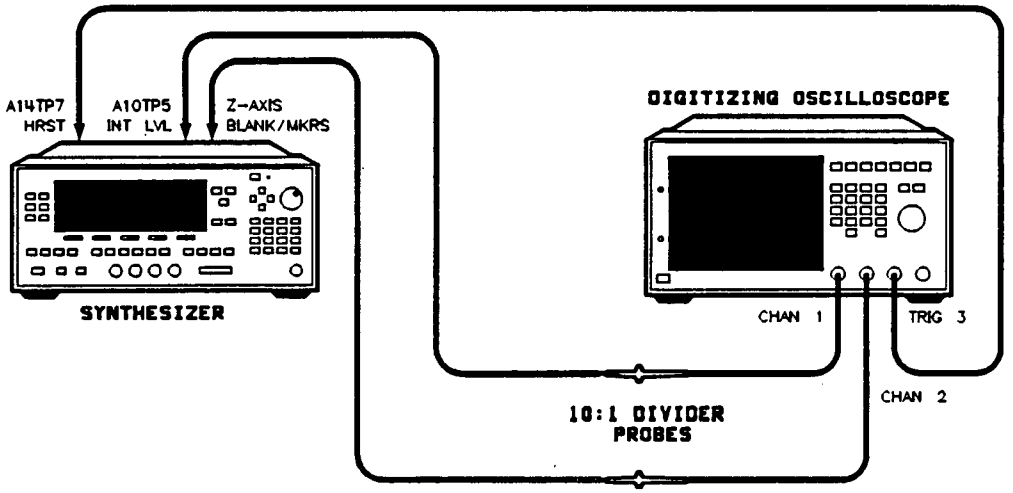


Figure 3-20. Low Power SRD Bias Adjustment Setup

2. On the synthesizer, set:
   [START] [7] [GHz]
   [STOP] [20] [GHz]
   [RF ON/OFF] On (amber light is on)
   [POWER LEVEL] [−20] [dBm]
   [SWEEP TIME] Fastest sweep time

3. On the oscilloscope, set:

Channel 1:

Display	On
Volts/Division	0.1 V
Input Coupling	dc
Input Impedance	1 MΩ

Channel 2:

Display	On
Preset	TTL
Input Impedance	1 MΩ

TIMEBASE:

Time/Division	2.5 ms
Delay	−2 ms
Delay Reference	At left
Sweep	Triggered

TRIGGER:

Trigger Mode	Events
Trigger	After negative edge
Trigger Source	Trig 3
Trigger	On 1 events
Trigger	Of negative edge
Trigger	On channel 2

DISPLAY:

Display Mode	Repetitive
Averaging	Off
Display Time	0.2 s

4. Adjust the oscilloscope channel 1 offset and timebase settings as necessary to center the traces on the display.
5. Save the oscilloscope setup in register 1.

6. On the oscilloscope, set:

   Trigger:
   Trigger On 2 events

7. Adjust the oscilloscope channel 1 offset and timebase settings as necessary to center the traces on the display.
8. Save the oscilloscope setup in register 2. Recall register 1.
9. Alternate between registers 1 and 2 and adjust A9R105 (MIN) for the minimum overall voltage as shown in Figure 3-21. See Figure 3-22 for the location of A9R105.

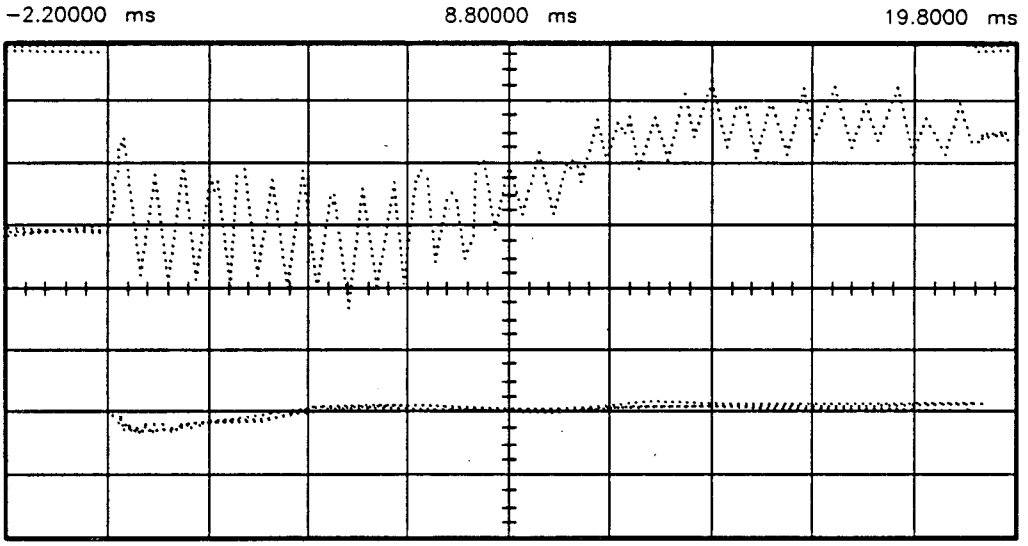


Figure 3-21. A9 Pulse Board MIN Adjustment

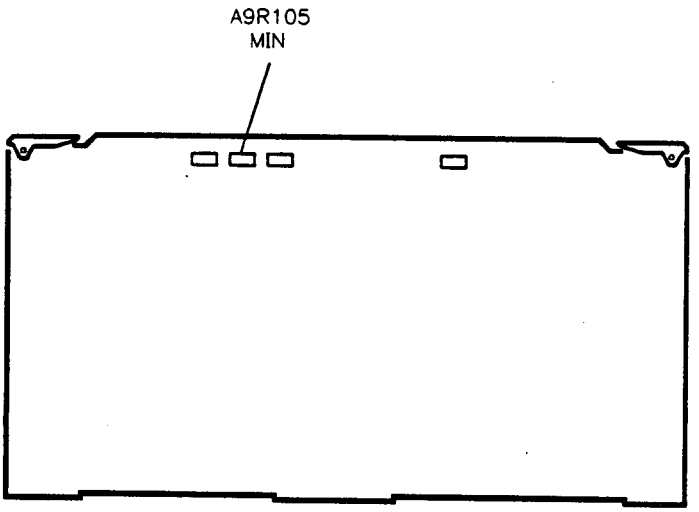


Figure 3-22. A9R105 Location

Related Performance Tests

None

In Case of Difficulty

Refer to the *Troubleshooting* manual.

12. Modulator Offset and Gain

Description and Procedure

In this procedure, the ALC modulation offset and gain calibration constants are adjusted to linearize the ALC modulator response to the ALC power level reference voltage. Default values are entered for the modulator offset calibration constants and internal firmware is activated to set the modulator gain calibration constants. The synthesizer is then set for a power sweep across the entire leveled ALC range (−20 to +10 dBm or the maximum leveled power). The integrator level signal on the ALC board is monitored to verify linearity. If necessary, the modulator offset values are modified.

1. Connect the equipment as shown in Figure 3-23. Preset the instruments and let them warm up for at least one hour.

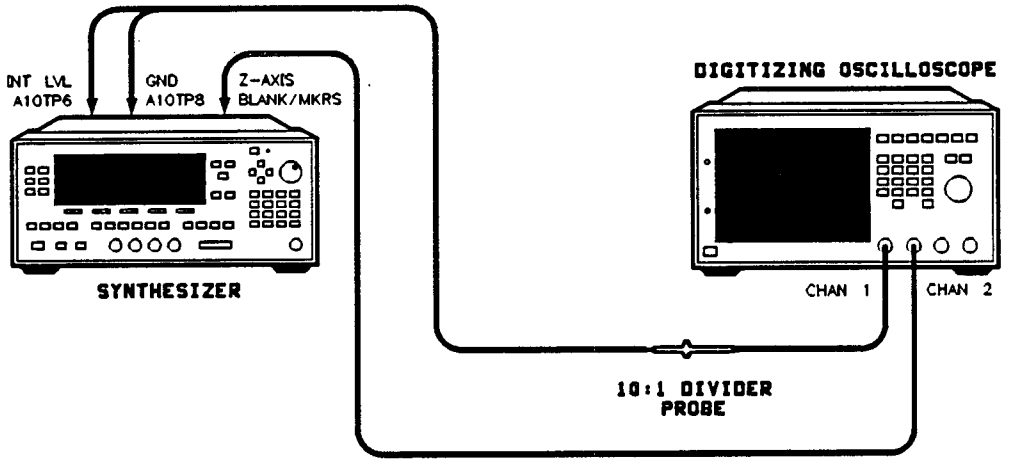


Figure 3-23. Modulator Offset and Gain Adjustment Setup

2. On the synthesizer, set:
   (SERVICE) Adjust Menu Calib Menu
3. Set the ALC offset calibration constants to the default values given in Table 3-5.

Select `Select Cal`. Using the numeric keypad, enter the number of the first calibration constant in Table 3-5. Terminate your entry with the (ENTER) key.

Select `Modify Cal`. Use the numeric keypad to enter the corresponding default value in Figure 3-23. Terminate your entry with the (ENTER) key.

4. Using the up/down arrow keys, select each of rest of the calibration constants in Figure 3-23 and set their default values by entering the value on the numeric keypad. Terminate your entry with the (ENTER) key.

Table 3-5. ALC Offset Calibration Constant Default Values

Calibration Constant	Description	Default Value
315	ALC Mod Ofs; Band 0	100
316	ALC Mod Ofs; Band 1	100
317	ALC Mod Ofs; Band 2	180
318	ALC Mod Ofs; Band 3	180
319	ALC Mod Ofs; Band 4	150
320	ALC Mod Ofs; Band 5	150
321	ALC Mod Ofs; Band 6	150
322	ALC Mod Ofs; Band 7	150

5. On the synthesizer, set:
(SERVICE) `Adjust Menu` `AssyAdj Menu` `A10 Adj Menu` `A10 Mod Gain`

The synthesizer will measure, calculate, and store the modulator gain calibration constants.

When the adjustment is completed the following message appears on the display:

```
Modulator Gain Cal Completed
Calibration constants were modified.
```

6. If this is the last calibration constant you will be adjusting, see "Calibration Constants" to store the calibration constants as protected data (in EEPROM).
7. Connect the oscilloscope as shown in Figure 3-23.
8. On the oscilloscope, set:

Channel 1:

Display	On
Volts/Division	50 mV
Offset	As necessary
Input Coupling	dc
Input Impedance	1 MΩ

Channel 2:

Display	On
Volts/Division	2V
Input Coupling	dc
Input Impedance	1 MΩ

Timebase:

Time/Division	10 ms
Delay	5 ms
Delay Reference	At left
Sweep	Triggered

Trigger:

Trigger Mode	Edge
Trigger Source	Channel 2
Trigger Level	2V
Trigger Slope	Negative

Display:

Display Mode	Repetitive
Averaging	On
Number of Averages	2

9. On the synthesizer, set:
   CW 1 GHz
   SPAN 0 GHz
   POWER LEVEL (–) 20 dBm
   POWER MENU POWER SWEEP 30 dB
   SWEEP TIME 100 msec
   USER CAL Tracking Menu Peak RF Always

   *For synthesizers with step attenuators, do not set the power level in this step. Instead set: POWER MENU Uncoupl Atten Set Atten 0 dB
   POWER LEVEL (–) 20 dBm

10. Adjust the oscilloscope timebase so the Z-axis input goes high at the right edge of the display. This signal is low during the power sweep.

11. Change the value of the band 0 calibration constant #315 as needed for a signal variation less than 200 mV during the power sweep (while Z-axis is low).

12. Set the synthesizer to each of the CW frequencies in Table 3-6. If the RF output goes unleveled, reduce the power sweep level until power is leveled. Then repeat step 11 for each corresponding calibration constant.

Table 3-6. CW Frequencies and Calibration Constants

CW Frequencies (GHz)	Calibration Constants
5.0	#316 Band 1
9.0	#317 Band 2
19.0	#318 Band 3
25.0	#319 Band 4[1]
30.0	#320 Band 5[1]
35.0	#321 Band 6[1]
45.0	#322 Band 7[1]

1 Not applicable for all models.

Related Performance Tests

Maximum Leveled Power

In Case of Difficulty

Refer to the *Troubleshooting* manual.

13. ALC Power Level Accuracy

Description and Procedure

This adjustment sets the absolute power accuracy in each frequency band at a CW frequency. The digital ALC calibration array is loaded with zeros for the 0 dB attenuator setting to eliminate any power offset from this source. Calibration constants set the power accuracy at four power levels. A potentiometer sets the power accuracy at an 18 dBm level in the low band (not applicable for all models).

NOTE: This adjustment procedure zeros the digital ALC calibration array at the 0 dB attenuator setting. The "Power Flatness" adjustment must be performed after this procedure.

1. Preset the equipment shown in Figure 3-24 and let them warm up for at least one hour. Do *not* connect the power sensor to the synthesizer RF OUTPUT yet.

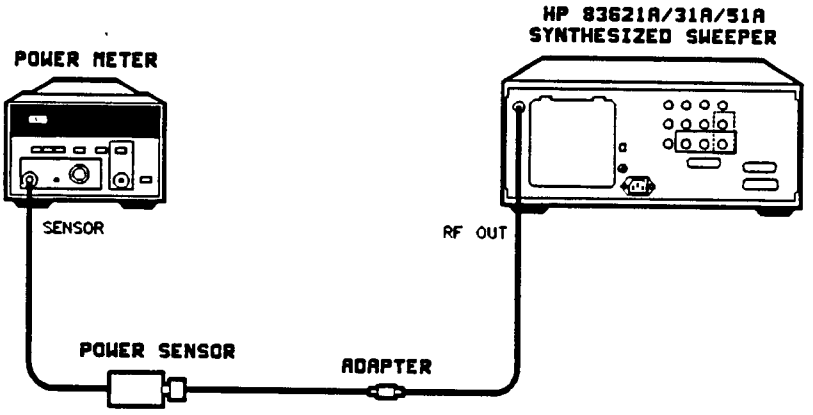


Figure 3-24. ALC Power Accuracy Adjustment Setup

2. Zero and calibrate the power meter/sensor and set the power meter to dBm mode. Connect the power sensor to the synthesizer's RF OUTPUT.

   Set the CAL FACTOR % for the power sensor 1 GHz calibration factor.

3. On the synthesizer, set:
   (USER CAL) Tracking Menu RF Peak Always (asterisk on)

4. On the synthesizer, zero the digital ALC calibration for the 0 dB attenuator setting for all frequency ranges:
   (SERVICE) Adjust Menu DigALC Menu
   AtnStep To Cal (0) (dB)
   Cal Freq Range Lo Band ALC Cal Array (Atn, Freq) Zero
   Cal Freq Range Hi Band ALC Cal Array (Atn, Freq) Zero

Note: The default values given in the next step are a general starting point. If the current ALC power accuracy is within 1 dB, fewer repetitions are required if you start with the existing calibration constants unchanged.

5. Set the default values given in Table 3-7 into the corresponding ALC calibration constants. On the synthesizer, set:
   (SERVICE) Adjust Menu Calib Menu

   Select Cal Enter the number of the calibration constant from Table 3-7 and terminate the entry with (ENTER).

   Modify Cal Enter the default value from Table 3-7 and terminate the entry with (ENTER).

Table 3-7. ALC Calibration Constants and Default Values

ALC Calibration Constant	Default Value
Low Band 0.01 to 2.0 GHz (not applicable for all models)	
#265 LVL DAC Ofs Lo Bnd	150
#252 LVL DAC Gain Lo Bnd	0
#284 ALC Det Ofs; Lo	128
#293 ALC Log Brkpt; Lo	128
High Band 2.0 to 20 GHz	
#264 LVL DAC Ofs Hi Bnd	0
#251 LVL DAC Gain Hi Bnd	0
#283 ALC Det Ofs; Hi	128
#292 ALC Log Brkpt; Hi	128

6. On the synthesizer, set:
   (CW) (1) (GHz)
   (SERVICE) Adjust Menu Calib Menu
7. On the synthesizer, set:
   (POWER LEVEL) First power level in Table 3-8
8. Select the first calibration constant in Table 3-8:
   (Select Cal) (265) (ENTER)
9. On the synthesizer, select Modify Cal and, using the rotary knob, modify the calibration constant so that the power meter and the power level setting are the same.
10. Repeat steps 8 through 10 for each power level and calibration constant given in Table 3-8.

Table 3-8. Power Level and Calibration Constant Adjustment

Power Level (dBm)	Calibration Constant Adjustment
0.0	#265 LVL DAC Ofs Lo Bnd
−10.0	#252 LVL DAC Gain Lo Bnd
−20.0	#284 ALC Det Ofs; Lo
+10.0	#293 ALC Det Log Brkpt; Lo

11. On the synthesizer, set:
    (POWER LEVEL) (18) (dBm)

    Adjust A10R125, +20 dBm, until the power meter and the power level setting are the same. Figure 3-25 shows the location of A10R125.

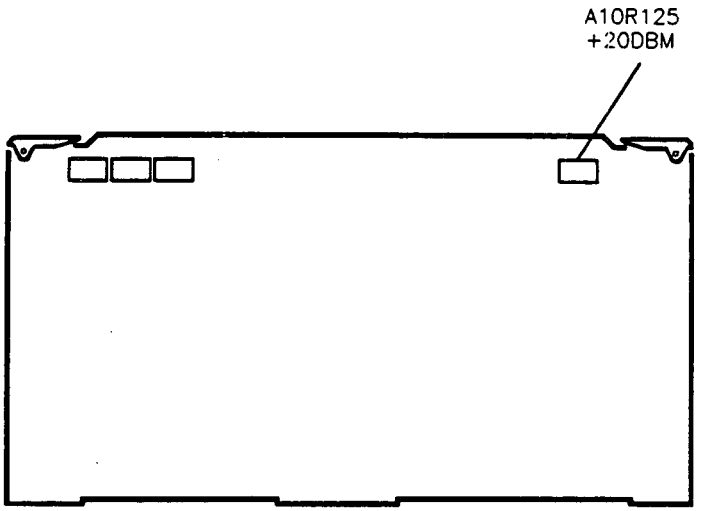


Figure 3-25. A10R125 Location

12. Repeat steps 8 through 12 until the power accuracy for each calibration constant is within ±0.01 dBm.

High Band Power Accuracy Adjustment

13. On the synthesizer, set:
    [CW] [10] [GHz]
    [SERVICE] `Adjust Menu` `Calib Menu`

14. On the power meter, set the CAL FACTOR % for the power sensor 10 GHz calibration factor.

15. On the synthesizer, set:

    [POWER LEVEL] First power level in Table 3-9

16. Select the first calibration constant in Table 3-9:

    [Select Cal] [264] [ENTER]

17. On the synthesizer, select `Modify Cal` and, using the rotary knob, modify the calibration constant so that the power meter and the power level setting are the same.

18. Repeat steps 16 through 18 for each power level and calibration constant given in Table 3-9.
19. Repeat steps 16 through 19 until the power accuracy for each calibration constant is within ±0.01 dBm.

Table 3-9. Power Level and Calibration Constant Adjustment

Power Level (dBm)	Calibration Constant Adjustment
0.0	#264 LVL DAC Ofs Hi Bnd
−10.0	#251 LVL DAC Gain Hi Bnd
−20.0	#283 ALC Det Ofs; Hi
+10.0	#292 ALC Det Log Brkpt; Hi

20. If this is the last calibration constant you will be adjusting, see "Calibration Constants" in this manual to store the calibration constants as protected data (in EEPROM).

Related Performance Tests

None

In Case of Difficulty

Refer to the *Troubleshooting* manual.

4 CALIBRATION CONSTANTS

4

Calibration Constants

Introduction

Viewing and editing the calibration constants of the synthesizer may be done using an automated test utility in software provided with this manual. These calibration constants may be protected with a user-defined password to prevent unauthorized access.

Refer to "Automated Tests" in this manual for an explanation of the calibration constants and front panel emulator utility software, and the program hardware and language requirements for running the software. Use the front panel emulator software to access the calibration constants, service menu, and password. This chapter describes the password and other specific information about the calibration constants.

This section contains the following information on calibration constants and how to use them:

- Definition.
- Memory Areas.
- Checksum Verification.
- Calibration Constant Password.
- Changing Working Data Calibration Constants.
- Saving Working Data Calibration Constants.
- Loading Protected Data Calibration Constants.
- Loading Default Data Calibration Constants.
- Calibration Constant Descriptions.

Definition

Calibration constants are data which describe your individual instrument. Calibration constants contain serial number prefix, hardware configuration, and board revision information. Calibration constants also contain calibration information specific to the operation of each instrument that is used to make sure that the instrument meets specifications.

Note: Changing calibration constants can cause your instrument to *not* meet specifications.

Memory Areas

The synthesizer has three memory areas reserved for calibration constants:

Working Data

Working data is the set of calibration constants accessed during normal operation and contains the calibration information required for optimum instrument performance. Working data is stored in RAM, and is maintained by a 1 farad capacitor.

Protected Data

Protected data resides in EEPROM. This calibration data is essentially the same as working data, but is not dependent on the capacitor. If the synthesizer's checksum test fails, or if the capacitor becomes discharged and working data is lost, the synthesizer copies protected data values into working data RAM.

Note: If the synthesizer is unplugged for a period greater than five days, the capacitor will be completely discharged. After reconnecting the synthesizer to line power, the capacitor will be completely recharged after 24 hours.

Default Data

Default data resides in UVEPROM. This data differs from working and protected data in that it cannot be changed. This data represents a typical synthesizer, and is not optimized for your instrument. The default calibration constants are a starting point for calibration. The synthesizer will probably *not* meet specifications. The synthesizer uses default data if a problem exists in both working and protected data or if you select `Default Cal` in the calibration utility menu.

Checksum Verification

At instrument power on, the calibration constants stored in RAM are added and compared with the checksum value. If the two values match, the current calibration constants are maintained in RAM.

If the RAM checksum does not verify, the calibration constants are loaded into RAM from EEPROM. These calibration constants are added and compared with their checksum value. If the two values match, these calibration constants (from EEPROM) are maintained in RAM.

If the RAM checksum still does not verify, the default calibration constants are loaded into RAM from UVEPROM. A message is displayed on the synthesizer indicating that the default calibration constants are in use. The synthesizer will probably *not* meet performance specifications. All the performance tests should be run.

Calibration Constant Password

The synthesizer is shipped with a factory-set password. A password disables access to the adjustment menu unless the password is entered (see "Entering a Password"). Calibration constants *cannot* be manually altered without accessing the adjustment menu.

The following is the factory-set password: 8360

You can set a new password. See "Setting a Password".

You can eliminate the password. See "Disabling a Password".

If you have forgotten the password, or if you require access to the calibration constant adjustments for calibration purposes and do not know the password, see "Bypassing the Password".

Entering a Password

An asterisk on the **Disable Adjust** softkey in the service menu indicates that a password is set. In order to access the adjustment menu you must enter that password:

1. Run the front panel emulator software and press (SERVICE) **Adjust Menu**.

   The following message is displayed: ENTER PASSWORD: 0

2. Enter the correct password using the numeric keypad and press (ENTER).

   The asterisk on the **Disable Adjust** softkey turns off.

3. Select **Adjust Menu** again to access the adjustment menu.

Entering the password allows permanent access to the adjustment menu, even if line power is cycled. To disable access again, set another password.

Disabling a Password

If you wish to eliminate a password (either the factory-set password or one you set yourself), perform the following:

1. Run the front panel emulator software and press (SERVICE) **Disable Adjust**.

The following message is displayed: ENTER PASSWORD: 0

2. Enter the current password using the numeric keypad and press (ENTER).

   The asterisk on the **Disable Adjust** softkey turns off.

Disabling the password allows permanent access to the adjustment menu, even if line power is cycled.

Setting a Password

If a password is already set on the synthesizer and you wish to change it, first follow the "Disabling a Password" procedure. This eliminates the current password. Then continue with this procedure.

If no password is set on the synthesizer (there is no asterisk on the **Disable Adjust** softkey), and you wish to set a password, perform the following:

1. Press (SERVICE) **Disable Adjust**.

   The following message is displayed: SET PASSWORD: 0

2. Enter the desired password using the numeric keypad. Up to 14 numeric digits are allowed. Terminate the entry by pressing: (ENTER).

3. A warning message is displayed informing you that the adjustment menus will no longer be accessible. To verify that you do wish to set the password, select **Yes, Confirm**.

   The asterisk on the **Disable Adjust** softkey turns on, indicating the password is set.

Bypassing the Password

If you require access to the adjustment menu for calibration purposes, a password is set, and you do not know the password, perform the following:

1. Turn off line power to the synthesizer.
2. Open A15S1 switch 5 (set the switch to the "1" position).
3. Turn on line power to the synthesizer and press (SERVICE).

The asterisk on the **Disable Adjust** softkey turns off enabling access to the adjustment menu.

When access to the adjustment menu is no longer desired, enable the previously set password. Perform the following:

4. Turn off line power to the synthesizer.
5. Close A15S1 switch 5 (set the switch to the "0" position).
6. Turn on line power to the synthesizer and press (SERVICE).

   The asterisk on the **Disable Adjust** softkey turns on indicating that you cannot access the adjustment menu.

If you have forgotten the password and wish to set a new one, perform steps 1 through 3 and then steps 7 through 10.

7. On the synthesizer, select **Disable Adjust**.

   The following message is displayed: `SET PASSWORD: 0`

8. Enter the desired password using the numeric keypad. Up to 14 numeric digits are allowed. Terminate the entry by pressing: (ENTER).
9. A warning message is displayed informing you that the adjustment menus will no longer be accessible. To verify that you do wish to set the password, select **Yes, Confirm**.
10. Another warning message is displayed informing you that the A15S1 switch 5 is set open. Complete steps 4 through 6 to close the switch and enable the password.

Changing Working Data Calibration Constants

If you need to modify the working data calibration constants, the following procedure accesses the calibration constants and lets you change them.

1. Run the front panel emulator software and press (SERVICE) `Adjust Menu` `Calib Menu`.
2. Select `Select Cal`.

   Enter the number of the calibration constant you wish to change using the up/down arrow keys, the rotary knob, or the numeric keypad. Terminate numeric keypad entries by pressing (ENTER).
3. Select `Modify Cal`.

   Change the value of the calibration constant using the right/left arrow keys, the rotary knob, or the numeric keypad. Terminate numeric keypad entries by pressing (ENTER).
4. Exit the calibration menu using the (PRIOR) key or by pressing (PRESET).

Saving Working Data Calibration Constants

In some adjustment procedures you will change working data calibration constants. The following procedure stores the calibration constants as protected data (in EEPROM).

1. Run the front panel emulator software and press (SERVICE) `Adjust Menu` `Calib Menu` `Cal Util Menu`.
2. Select `Save Cal`.

   A warning is displayed informing you that changing the calibration constants may drastically affect instrument performance. To verify that you do wish to save the new calibration constants, select `yes`.

   The working data calibration constants are now stored as protected data (in EEPROM).

3. Exit the calibration utility menu using the (PRIOR) key or pressing (PRESET).

Loading Protected Data Calibration Constants

If your working data calibration constants have been altered or deleted, the following procedure loads the protected calibration constants from EEPROM into working data memory.

1. Run the front panel emulator software and press (SERVICE) `Adjust Menu` `Calib Menu` `Cal Util Menu`.
2. Select `Recall Cal`.

   A warning is displayed informing you that changing the calibration constants may drastically affect instrument performance. To verify that you do wish to recall the protected data calibration constants, select `yes`.

   The protected data calibration constants are now loaded into working data.
3. Exit the calibration utility menu using the (PRIOR) key or pressing (PRESET).

Loading Default Data Calibration Constants

If you want to use the generic synthesizer calibration constants as working data, the following procedure loads the default calibration constants from UVEPROM into working data memory.

1. Run the front panel emulator software and press (SERVICE) `Adjust Menu` `Calib Menu` `Cal Util Menu`.
2. Select `Defaultl Cal`.

   A warning is displayed informing you that changing the calibration constants may drastically affect instrument performance. To verify that you do wish to recall the default calibration constants, select `yes`.

   The default data calibration constants are now loaded into working data.

3. Exit the calibration utility menu using the PRIOR key or pressing PRESET.

Calibration Constant Descriptions

Table 4-9 provides the following information for each calibration constant:

- The calibration constant number in ascending order.
- The calibration constant name. An asterisk indicates that this calibration constant is adjusted by an automated adjustment.
- The range of realistic adjustment (adjustment outside of the range may be possible but will probably cause the synthesizer to be severely misadjusted) or the default value (some calibration constants are set to a default value and are not adjustable).
- The related adjustment procedure, manual, automated, or front panel, that adjusts that calibration constant.

Note: Blank calibration constants are reserved for future use.

Table 4-9. Calibration Constant Descriptions

Number	Description	Range or Default	Related Adjustment
1	Identifier Response	2	
2	Dwell After RF On	2	
3	User Configuration	0	
4	Lockout Features	0	
5	Display Field Lock	0	
6	Retrace Dwell Time	0	
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	Production Info 1	0	
17	Production Info 2	0	
18	Production Info 3	0	
19	Production Info 4	0	
20	Production Info 5	0	
21	Lock Dwell Time	2	
22	Max Ph Lk Wait	100	
23	YO Slew Rate	500	
24	YO Kick Max	6000	
25	YO Settle Rate	20	
26			
27			
28			
29			
30			
31			
32			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
33			
34			
35			
36	YO Dly Term A Bnd 0	400 to 800	YO Delay Adjustment
37	YO Dly Term A Bnd 1	400 to 800	YO Delay Adjustment
38	YO Dly Term A Bnd 2	400 to 800	YO Delay Adjustment
39	YO Dly Term A Bnd 3	400 to 800	YO Delay Adjustment
40	YO Dly Term A Bnd 4	400 to 800	YO Delay Adjustment
41	YO Dly Term A Bnd 5	400 to 800	YO Delay Adjustment
42	YO Dly Term A Bnd 6	400 to 800	YO Delay Adjustment
43	YO Dly Term A Bnd 7	400 to 800	YO Delay Adjustment
44			
45			
46			
47			
48			
49			
50	YO Dly Term B Bnd 0	300 to 700	YO Delay Adjustment
51	YO Dly Term B Bnd 1	300 to 700	YO Delay Adjustment
52	YO Dly Term B Bnd 2	300 to 700	YO Delay Adjustment
53	YO Dly Term B Bnd 3	300 to 700	YO Delay Adjustment
54	YO Dly Term B Bnd 4	300 to 700	YO Delay Adjustment
55	YO Dly Term B Bnd 5	300 to 700	YO Delay Adjustment
56	YO Dly Term B Bnd 6	300 to 700	YO Delay Adjustment
57	YO Dly Term B Bnd 7	300 to 700	YO Delay Adjustment
58			
59			
60			
61			
62			
63			
64			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
65			
66			
67			
68			
69			
70			
71			
72	*CW Offset	−500 to +500	YO Driver Gain And Linearity
73	YO Off Ver; Band 0	0	
74	YO Off Ver; Band 1	0	
75	YO Off Ver; Band 2	0	
76	YO Off Ver; Band 3	0	
77	YO Off Ver; Band 4	0	
78	YO Off Ver; Band 5	0	
79	YO Off Ver; Band 6	0	
80	YO Off Ver; Band 7	0	
81			
82			
83			
84			
85			
86			
87	YO Swp Ver; Band 0	0	
88	YO Swp Ver; Band 1	0	
89	YO Swp Ver; Band 2	0	
90	YO Swp Ver; Band 3	0	
91	YO Swp Ver; Band 4	0	
92	YO Swp Ver; Band 5	0	
93	YO Swp Ver; Band 6	0	
94	YO Swp Ver; Band 7	0	
95			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
96			
97			
98			
99			
100			
101	YTM Temp Coefficient	0	
102			
103			
104			
105	SRD Bias A; Band 1	255	Amp/Multiplier Adjustments
106	SRD Bias A; Band 2	30 to 200	Amp/Multiplier Adjustments
107	SRD Bias A; Band 3	30 to 200	Amp/Multiplier Adjustments
108	SRD Bias A; Band 4	30 to 200	Amp/Multiplier Adjustments
109	SRD Bias A; Band 5	30 to 200	Amp/Multiplier Adjustments
110	SRD Bias A; Band 6	30 to 200	Amp/Multiplier Adjustments
111	SRD Bias A; Band 7	30 to 200	Amp/Multiplier Adjustments
112			
113			
114			
115			
116			
117			
118	SRD Bias B; Band 1	30 to 210	Amp/Multiplier Adjustments
119	SRD Bias B; Band 2	30 to 210	Amp/Multiplier Adjustments
120	SRD Bias B; Band 3	30 to 210	Amp/Multiplier Adjustments
121	SRD Bias B; Band 4	30 to 210	Amp/Multiplier Adjustments
122	SRD Bias B; Band 5	30 to 210	Amp/Multiplier Adjustments
123	SRD Bias B; Band 6	30 to 210	Amp/Multiplier Adjustments
124	SRD Bias B; Band 7	30 to 210	Amp/Multiplier Adjustments

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
125			
126			
127			
128			
129			
130			
131	Squegg Clamp 1A	40 to 170	Amplifier/Filter Adjustments
132	Squegg Clamp 2A	255	Amplifier/Filter Adjustments
133	Squegg Clamp 3A	255	Amplifier/Filter Adjustments
134	Squegg Clamp 4A	255	Amplifier/Filter Adjustments
135	Squegg Clamp 5A	255	Amplifier/Filter Adjustments
136	Squegg Clamp 6A	255	Amplifier/Filter Adjustments
137	Squegg Clamp 7A	255	Amplifier/Filter Adjustments
138			
139			
140			
141			
142			
143			
144	YTM Dly Term A Hrm 1	1300	Amplifier/Filter Adjustments
145	YTM Dly Term A Hrm 2	1400	Amplifier/Filter Adjustments
146	YTM Dly Term A Hrm 3	1500	Amplifier/Filter Adjustments
147	YTM Dly Term A Hrm 4	1800	Amplifier/Filter Adjustments
148	YTM Dly Term A Hrm 5	1500	Amplifier/Filter Adjustments
149	YTM Dly Term A Hrm 6	1500	Amplifier/Filter Adjustments
150	YTM Dly Term A Hrm 7	1800	Amplifier/Filter Adjustments
151			
152			
153			
154			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
155			
156			
157	YTM Dly Term B Hrm 1	300	Amplifier/Filter Adjustments
158	YTM Dly Term B Hrm 2	300	Amplifier/Filter Adjustments
159	YTM Dly Term B Hrm 3	350	Amplifier/Filter Adjustments
160	YTM Dly Term B Hrm 4	350	Amplifier/Filter Adjustments
161	YTM Dly Term B Hrm 5	350	Amplifier/Filter Adjustments
162	YTM Dly Term B Hrm 6	350	Amplifier/Filter Adjustments
163	YTM Dly Term B Hrm 7	350	Amplifier/Filter Adjustments
164			
165			
166			
167			
168			
169			
170	YTM Bx Dly Term A 1	1300	Amp/Multiplier Adjustments
171	YTM Bx Dly Term A 2	1400	Amp/Multiplier Adjustments
172	YTM Bx Dly Term A 3	600 to 2500	Amp/Multiplier Adjustments
173	YTM Bx Dly Term A 4	600 to 2500	Amp/Multiplier Adjustments
174	YTM Bx Dly Term A 5	1500	Amp/Multiplier Adjustments
175	YTM Bx Dly Term A 6	1500	Amp/Multiplier Adjustments
176	YTM Bx Dly Term A 7	1800	Amp/Multiplier Adjustments
177			
178			
179			
180			
181			
182			
183	YTM Bx Dly Term B 1	300	Amp/Multiplier Adjustments
184	YTM Bx Dly Term B 2	300	Amp/Multiplier Adjustments
185	YTM Bx Dly Term B 3	200 to 450	Amp/Multiplier Adjustments

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
186	YTM Bx Dly Term B 4	200 to 450	Amp/Multiplier Adjustments
187	YTM Bx Dly Term B 5	320	Amp/Multiplier Adjustments
188	YTM Bx Dly Term B 6	320	Amp/Multiplier Adjustments
189	YTM Bx Dly Term B 7	350	Amp/Multiplier Adjustments
190			
191			
192			
193			
194			
195	YTM Kick Threshold	110	Amp/Multiplier Adjustments
196	YTM CW Kick Max	3600	Amp/Multiplier Adjustments
197	YTM Mono Band Kick	2000	Amp/Multiplier Adjustments
198	YTM Stereo Band Kick	2000	Amp/Multiplier Adjustments
199	YTM Slew Rate	400	Amp/Multiplier Adjustments
200	YTM Slew Max	50	
201	YTM Slew Min	0	
202	YTM Neg Kick Wait	2	
203	YTM Fwd Kick Pct	50	
204	YTM Fwd Kick Wait	30	
205	YTM Rise; Band 1	1 to 20	Amplifier/Filter Adjustments
206	YTM Rise; Band 2 A1	20 to 25	Amplifier/Filter Adjustments
207	YTM Rise; Band 2 B1	1 to 4	Amplifier/Filter Adjustments
208	YTM Rise; Band 2 A2	10 to 20	Amplifier/Filter Adjustments
209	YTM Rise; Band 3 A1	5 to 100	Amplifier/Filter Adjustments
210	YTM Rise; Band 3 B1	0 to 20	Amplifier/Filter Adjustments
211	YTM Rise; Band 3 A2	5 to 100	Amplifier/Filter Adjustments
212	YTM Rise; Band 3 B2	0 to 20	Amplifier/Filter Adjustments
213	YTM Rise; Band 3 A3	1 to 20	Amplifier/Filter Adjustments
214	YTM Rise; Band 4	1 to 100	Amplifier/Filter Adjustments
215	YTM Rise; Band 5	1 to 50	Amplifier/Filter Adjustments

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
216	YTM Rise; Band 6	1 to 50	Amplifier/Filter Adjustments
217	YTM Rise; Band 7	1 to 50	Amplifier/Filter Adjustments
218			
219			
220			
221			
222			
223			
224			
225	*YTM Gain; Band 1	1500 to 2500	Amp/Multiplier Adjustments; Auto Track
226	*YTM Gain; Band 2	1000 to 2500	Amp/Multiplier Adjustments; Auto Track
227	*YTM Gain; Band 3	500 to 2500	Amp/Multiplier Adjustments; Auto Track
228	*YTM Gain; Band 4	500 to 2500	Amp/Multiplier Adjustments; Auto Track
229	*YTM Gain; Band 5	500 to 2500	Amp/Multiplier Adjustments; Auto Track
230	*YTM Gain; Band 6	500 to 2500	Amp/Multiplier Adjustments; Auto Track
231	*YTM Gain; Band 7	500 to 2500	Amp/Multiplier Adjustments; Auto Track
232			
233			
234			
235			
236			
237			
238	*YTM Offset; Band 1	1500 to 2500	Amp/Multiplier Adjustments; Auto Track
239	*YTM Offset; Band 2	1500 to 3000	Amp/Multiplier Adjustments; Auto Track
240	*YTM Offset; Band 3	1500 to 3000	Amp/Multiplier Adjustments; Auto Track

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
241	*YTM Offset; Band 4	1500 to 3000	Amp/Multiplier Adjustments; Auto Track
242	*YTM Offset; Band 5	1500 to 3000	Amp/Multiplier Adjustments; Auto Track
243	*YTM Offset; Band 6	1500 to 3000	Amp/Multiplier Adjustments; Auto Track
244	*YTM Offset; Band 7	1500 to 3000	Amp/Multiplier Adjustments; Auto Track
245			
246			
247			
248	YTM B2 Offset Offset	0	Amp/Multiplier Adjustments
249			
250			
251	*LVL DAC Gain Hi Bnd	−100 to +100	ALC Power Level Accuracy; Detector Cal
252	*LVL DAC Gain Lo Bnd	−100 to +100	ALC Power Level Accuracy; Detector Cal
253	*LVL DAC Gain Xtal	−100 to +100	Detector Cal
254	*LVL DAC Gain 2ndOut	0	
255	*LVL DAC Gain PwrMtr	−100 to +100	
256	*LVL DAC Gain Module	−100 to +100	
257	*LVL DAC Gain ALC Off	0	
258			
259			
260			
261			
262			
263			
264	*LVL DAC Ofs Hi Bnd	−50 to +300	ALC Power Level Accuracy\Detector Cal
265	*LVL DAC Ofs Lo Bnd	100 to 250	ALC Power Level Accuracy\Detector Cal
266	*LVL DAC Ofs Xtal	−1000 to +1000	Detector Cal

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
267	*LVL DAC Ofs 2ndOut	0	
268	*LVL DAC Ofs PwrMtr	−100 to +100	
269	*LVL DAC Ofs Module	−100 to +100	
270	*LVL DAC Ofs ALC Off	0	
271			
272			
273			
274			
275	FM DAC Gain Trim	0	
276	AM DAC Gain Trim		
277	AM Offset	−20 to +20	
278			
279			
280			
281			
282			
283	*ALC Det Ofs; Hi	100 to 160	ALC Power Level Accuracy; `Detector Cal`
284	*ALC Det Ofs; Lo	100 to 160	ALC Power Level Accuracy; `Detector Cal`
285	*ALC Det Ofs; Xtal	100 to 160	
286	*ALC Det Ofs; 2nd Out	100 to 160	
287			
288			
289			
290			
291			
292	*ALC Log Brkpt; Hi	0 to 255	ALC Power Level Accuracy; `Detector Cal`
293	*ALC Log Brkpt; Lo	0 to 255	ALC Power Level Accuracy; `Detector Cal`
294	*ALC Log Brkpt; Xtal	0 to 255	
295	*ALC Log Brkpt; 2nd	0 to 255	

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
296			
297			
298			
299			
300			
301	*ALC Mod Gain; Band 0	100 to 200	Modulator Offset And Gain
302	*ALC Mod Gain; Band 1	100 to 200	Modulator Offset And Gain
303	*ALC Mod Gain; Band 2	40 to 100	Modulator Offset And Gain
304	*ALC Mod Gain; Band 3	40 to 100	Modulator Offset And Gain
305	*ALC Mod Gain; Band 4	40 to 100	Modulator Offset And Gain
306	*ALC Mod Gain; Band 5	40 to 100	
307	*ALC Mod Gain; Band 6	40 to 100	
308	*ALC Mod Gain; Band 7	40 to 100	
309			
310			
311			
312			
313			
314			
315	ALC Mod Ofs; Band 0	50 to 150	Modulator Offset And Gain
316	ALC Mod Ofs; Band 1	50 to 150	Modulator Offset And Gain
317	ALC Mod Ofs; Band 2	150 to 220	Modulator Offset And Gain
318	ALC Mod Ofs; Band 3	150 to 220	Modulator Offset And Gain
319	ALC Mod Ofs; Band 4	100 to 200	Modulator Offset And Gain
320	ALC Mod Ofs; Band 5	100 to 200	
321	ALC Mod Ofs; Band 6	100 to 200	
322	ALC Mod Ofs; Band 7	100 to 200	
323			
324			
325			
326			
327			
328			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
329	Slow Sym Low Band	100 to 160	
330	Slow Sym High Band	100 to 160	
331	Attenuator Sw Point	−1000	
332			
333			
334			
335	Squegg Clamp 1B	0	
336	Squegg Clamp 2B	0	
337	Squegg Clamp 3B	0	
338	Squegg Clamp 4B	0	
339	Squegg Clamp 5B	0	
340	Squegg Clamp 6B	0	
341	Squegg Clamp 7B	0	
342			
343			
344			
345			
346			
347			
348			
349			
350			
351	ADC 5V Range +OFF	−5000 to +5000	ADC Adjustment
352	ADC 15V Range +OFF	−5000 to +5000	ADC Adjustment
353	ADC 5V Range +GAIN	−1950 to +1950	ADC Adjustment
354	ADC 15V Range +GAIN	−750 to +750	ADC Adjustment
355	ADC 5V Range −OFF	−5000 to +5000	ADC Adjustment
356	ADC 15V Range −OFF	−5000 to +5000	ADC Adjustment
357	ADC 5V Range −GAIN	−750 to +750	ADC Adjustment
358	ADC 15V Range −GAIN	−1750 to +1950	ADC Adjustment
359			
360			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
361			
362			
363			
364			
365			
366			
367	PwrMtr Gain; Lo Band	0	
368	PwrMtr Gain; Hi Band	0	
369	Pwr Mtr Offset	0	
370			
371			
372			
373	YTM Dly Term C Hrm 1	0	
374	YTM Dly Term C Hrm 2	0	
375	YTM Dly Term C Hrm 3	0	
376	YTM Dly Term C Hrm 4	0	
377	YTM Dly Term C Hrm 5	0	
378	YTM Dly Term C Hrm 6	0	
379	YTM Dly Term C Hrm 7	0	
380			
381			
382	YTM Bx Dly Term C 1	0	
383	YTM Bx Dly Term C 2	0	
384	YTM Bx Dly Term C 3	0	
385	YTM Bx Dly Term C 4	0	
386	YTM Bx Dly Term C 5	0	
387	YTM Bx Dly Term C 6	0	
388	YTM Bx Dly Term C 7	0	
389			
390			
391			
392			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
393	*Loop Gain: 200.0 MHz	10 to 20	Sampler Assembly
394	*Loop Gain: 200.5 MHz	10 to 20	Sampler Assembly
395	*Loop Gain: 201.0 MHz	10 to 20	Sampler Assembly
396	*Loop Gain: 201.5 MHz	10 to 20	Sampler Assembly
397	*Loop Gain: 202.0 MHz	10 to 20	Sampler Assembly
398	*Loop Gain: 202.5 MHz	10 to 20	Sampler Assembly
399	*Loop Gain: 203.0 MHz	10 to 20	Sampler Assembly
400	*Loop Gain: 203.5 MHz	10 to 20	Sampler Assembly
401	*Loop Gain: 204.0 MHz	10 to 20	Sampler Assembly
402	*Loop Gain: 204.5 MHz	10 to 20	Sampler Assembly
403	*Loop Gain: 205.0 MHz	10 to 20	Sampler Assembly
404	*Loop Gain: 205.5 MHz	10 to 20	Sampler Assembly
405	*Loop Gain: 206.0 MHz	10 to 20	Sampler Assembly
406	*Loop Gain: 206.5 MHz	10 to 20	Sampler Assembly
407	*Loop Gain: 207.0 MHz	10 to 20	Sampler Assembly
408	*Loop Gain: 207.5 MHz	10 to 20	Sampler Assembly
409	*Loop Gain: 208.0 MHz	10 to 20	Sampler Assembly
410	*Loop Gain: 208.5 MHz	10 to 20	Sampler Assembly
411	*Loop Gain: 209.0 MHz	10 to 20	Sampler Assembly
412	*Loop Gain: 209.5 MHz	10 to 20	Sampler Assembly
413	*Loop Gain: 210.0 MHz	10 to 20	Sampler Assembly
414	*Loop Gain: 210.5 MHz	10 to 20	Sampler Assembly
415	*Loop Gain: 211.0 MHz	10 to 20	Sampler Assembly
416	*Loop Gain: 211.5 MHz	12 to 24	Sampler Assembly
417	*Loop Gain: 212.0 MHz	13 to 26	Sampler Assembly
418	*Loop Gain: 212.5 MHz	14 to 28	Sampler Assembly
419	*Loop Gain: 213.0 MHz	14 to 28	Sampler Assembly
420	*Loop Gain: 213.5 MHz	15 to 30	Sampler Assembly
421	*Loop Gain: 214.0 MHz	16 to 32	Sampler Assembly
422	*Loop Gain: 214.5 MHz	17 to 34	Sampler Assembly
423	*Loop Gain: 215.0 MHz	18 to 36	Sampler Assembly

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
424	*Loop Gain: 215.5 MHz	18 to 36	Sampler Assembly
425	*Loop Gain: 216.0 MHz	19 to 38	Sampler Assembly
426	*Loop Gain: 216.5 MHz	20 to 40	Sampler Assembly
427	*Loop Gain: 217.0 MHz	22 to 44	Sampler Assembly
428	*Loop Gain: 217.5 MHz	23 to 46	Sampler Assembly
429	*Loop Gain: 218.0 MHz	24 to 48	Sampler Assembly
430	*Loop Gain: 218.5 MHz	28 to 56	Sampler Assembly
431	*Loop Gain: 219.0 MHz	30 to 60	Sampler Assembly
432	*Loop Gain: 219.5 MHz	32 to 64	Sampler Assembly
433	*Loop Gain: 220.0 Mhz	32 to 64	Sampler Assembly
434			
435			
436			
437			
438			
439			
440	Doubler Amp Mode	0	
441	Phuoc Magic Enable	0	
442	*Sweeptime Range 0	3750 to 6250	Sweep Ramp
443	*Sweeptime Range 1	19655 to 32755	Sweep Ramp
444	*Sweeptime Range 2	9360 to 15600	Sweep Ramp
445			
446			
447			
448			
449			
450			
451			
452			
453			
454			
455			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
456			
457			
458			
459			
460	Debugs	0	
461	Serial Numb Prefix	See footnote 1	
462			
463	Hardware Config	See footnote 1	
464			
465			
466			
467			
468			
469			
470			
471			
472			
473	Power Spec Band 0	See footnote 2	
474	Power Spec Band 1	See footnote 2	
475	Power Spec Band 2	See footnote 2	
476	Power Spec Band 3	See footnote 2	
477	Power Spec Band 4	See footnote 2	
478	Power Spec Band 5	See footnote 2	
479	Power Spec Band 6	See footnote 2	
480	Power Spec Band 7	See footnote 2	
481			
482			
483			
484			
485			
486			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
487	Max Sweep Rate	300	
488	Max Sweep Rate 8516	100	
489			
490			
491			
492			
493	A1 Revision	Indicates assembly revision affecting firmware	
494	A2 Revision	Indicates assembly revision affecting firmware	
495	A3 Revision	Indicates assembly revision affecting firmware	
496	A4 Revision	Indicates assembly revision affecting firmware	
497	A5 Revision	Indicates assembly revision affecting firmware	
498	A6 Revision	Indicates assembly revision affecting firmware	
499	A7 Revision	Indicates assembly revision affecting firmware	
500	A8 Revision	Indicates assembly revision affecting firmware	
501	A9 Revision	Indicates assembly revision affecting firmware	
502	A10 Revision	Indicates assembly revision affecting firmware	
503	A11 Revision	Indicates assembly revision affecting firmware	
504	A12 Revision	Indicates assembly revision affecting firmware	
505	A13 Revision	Indicates assembly revision affecting firmware	
506	A14 Revision	Indicates assembly revision affecting firmware	
507	A15 Revision	Indicates assembly revision affecting firmware	

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
508	A16 Revision	Indicates assembly revision affecting firmware	
509	A17 Revision	Indicates assembly revision affecting firmware	
510	A18 Revision	Indicates assembly revision affecting firmware	
511	A19 Revision	Indicates assembly revision affecting firmware	
512	A20 Revision	Indicates assembly revision affecting firmware	
513	A21 Revision	Indicates assembly revision affecting firmware	
514	A22 Revision	Indicates assembly revision affecting firmware	
515	A23 Revision	Indicates assembly revision affecting firmware	
516			
517			
518			
519			
520			
521			
522			
523			
524			
525	Hibernation Time	90	
526	Bandcross Time 1	42	
527	Bandcross Time 2	32	
528	Bandcross Time 3	28	
529	Bandcross Time 4	26	
530	Bandcross Time 5	28	
531	Bandcross Time 6	20	
532	Bandcross Time 7	20	

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
533			
534			
535			
536	Special Option 1	0	
537	Special Option 2	0	
538	Special Option 3	0	
539	Special Option 4	0	
540	Special Option 5	0	
541	Special Option 6	0	
542	Special Option 7	0	
543	Special Option 8	0	
544	Special Option 9	0	
545	Special Option 10	0	
546			
547			
548			
549			
550			
551			
552			
553			
554	Display FIFO Time	245	
555	Display FSCC Time	1	
556			
557			
558			
559			
560			
561	YTF Dly Term A Hrm 1	1300	Amplifier/Filter Adjustments
562	YTF Dly Term A Hrm 2	1400	Amplifier/Filter Adjustments
563	YTF Dly Term A Hrm 3	1500	Amplifier/Filter Adjustments
564	YTF Dly Term A Hrm 4	1800	Amplifier/Filter Adjustments
565	YTF Dly Term A Hrm 5	1500	Amplifier/Filter Adjustments

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
566	YTF Dly Term A Hrm 6	1500	Amplifier/Filter Adjustments
567	YTF Dly Term A Hrm 7	1800	Amplifier/Filter Adjustments
568			
569			
570			
571	YTF Dly Term B Hrm 1	300	Amplifier/Filter Adjustments
572	YTF Dly Term B Hrm 2	300	Amplifier/Filter Adjustments
573	YTF Dly Term B Hrm 3	350	Amplifier/Filter Adjustments
574	YTF Dly Term B Hrm 4	350	Amplifier/Filter Adjustments
575	YTF Dly Term B Hrm 5	350	Amplifier/Filter Adjustments
576	YTF Dly Term B Hrm 6	350	Amplifier/Filter Adjustments
577	YTF Dly Term B Hrm 7	350	Amplifier/Filter Adjustments
578			
579			
580			
581	YTF Dly Term C Hrm 1	0	
582	YTF Dly Term C Hrm 2	0	
583	YTF Dly Term C Hrm 3	0	
584	YTF Dly Term C Hrm 4	0	
585	YTF Dly Term C Hrm 5	0	
586	YTF Dly Term C Hrm 6	0	
587	YTF Dly Term C Hrm 7	0	
588			
589			
590			
591	YTF Bx Dly Term A 1	1300	Amplifier/Filter Adjustments
592	YTF Bx Dly Term A 2	1400	Amplifier/Filter Adjustments
593	YTF Bx Dly Term A 3	600 to 2500	Amplifier/Filter Adjustments
594	YTF Bx Dly Term A 4	600 to 2500	Amplifier/Filter Adjustments
595	YTF Bx Dly Term A 5	1500	Amplifier/Filter Adjustments
596	YTF Bx Dly Term A 6	1500	Amplifier/Filter Adjustments
597	YTF Bx Dly Term A 7	1800	Amplifier/Filter Adjustments
598			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
599			
600			
601	YTF Bx Dly Term B 1	300	Amplifier/Filter Adjustments
602	YTF Bx Dly Term B 2	300	Amplifier/Filter Adjustments
603	YTF Bx Dly Term B 3	200 to 450	Amplifier/Filter Adjustments
604	YTF Bx Dly Term B 4	200 to 450	Amplifier/Filter Adjustments
605	YTF Bx Dly Term B 5	250	Amplifier/Filter Adjustments
606	YTF Bx Dly Term B 6	250	Amplifier/Filter Adjustments
607	YTF Bx Dly Term B 7	250	Amplifier/Filter Adjustments
608			
609			
610			
611	YTF Bx Dly Term C 1	0	
612	YTF Bx Dly Term C 2	0	
613	YTF Bx Dly Term C 3	0	
614	YTF Bx Dly Term C 4	0	
615	YTF Bx Dly Term C 5	0	
616	YTF Bx Dly Term C 6	0	
617	YTF Bx Dly Term C 7	0	
618			
619			
620			
621	*YTF Gain; Band 1	1500 to 2500	Amplifier/Filter Adjustments
622	*YTF Gain; Band 2	1000 to 2500	Amplifier/Filter Adjustments
623	*YTF Gain; Band 3	500 to 2500	Amplifier/Filter Adjustments
624	*YTF Gain; Band 4	500 to 2500	Amplifier/Filter Adjustments
625	*YTF Gain; Band 5	500 to 2500	Amplifier/Filter Adjustments
626	*YTF Gain; Band 6	500 to 2500	Amplifier/Filter Adjustments
627	*YTF Gain; Band 7	500 to 2500	Amplifier/Filter Adjustments
628			
629			
630			

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
631	*YTF Offset; Band 1	1500 to 2500	Amplifier/Filter Adjustments
632	*YTF Offset; Band 2	1500 to 3000	Amplifier/Filter Adjustments
633	*YTF Offset; Band 3	1500 to 3000	Amplifier/Filter Adjustments
634	*YTF Offset; Band 4	1500 to 3000	Amplifier/Filter Adjustments
635	*YTF Offset; Band 5	1500 to 3000	Amplifier/Filter Adjustments
636	*YTF Offset; Band 6	1500 to 3000	Amplifier/Filter Adjustments
637	*YTF Offset; Band 7	1500 to 3000	Amplifier/Filter Adjustments
638			
639			
640			
641	A24 Rev;Low Band	0	
642	A25 Rev;Mod Splitter	0	
643	A26 Rev;YIG Osc	0	
644	A27 Rev;Isolator	0	
645	A28 Rev;SYTM	0	
646	A29 Rev;Amp/Detector	0	
647	A30 Rev;Coupler	0	
648	A31 Rev;Attenuator	0	
649	A32 Rev;Doubler	0	
650	A33 Rev;Amplifier	0	
651	A34 Rev;RP Assembly	0	
652	A35 Rev;Isolator	0	
653	A36 Rev;Pulse Mod	0	
654			
655			
656			
657			
658			
659			
660	Quick Step Slew 0	5	
661	Quick Step Slew 1	5	
662	Quick Step Slew 2	10	
663	Quick Step Slew 3	15	

Table 4-9. Calibration Constant Descriptions (continued)

Number	Description	Range or Default	Related Adjustment
664	Quick Step Slew 4	17	
665	Quick Step Slew 5	26	
666	Quick Step Slew 6	26	
667	Quick Step Slew 7	35	
668			
669			
670	Rf Interface ID	0	
671	A9 Pulse Board ID	1	
672	A12 YTM Driver ID	1	
673			
674			
675			
676			
677			
678			
679			
680			
681			
682			
683			
684			
685			
686			
687			
688			
689			
690			

[1] Specific to the synthesizer's hardware configuration. The calibration constant value is set at the factory.

[2] Specified maximum leveled power for the band (for example, 7 dBm equals 700, 10 dBm equals 1000).

5 AUTOMATED TESTS

5

Automated Tests

Introduction

Included with this manual is software that automates some adjustments, allows the changing of calibration constants, and provides utilities such as a front panel emulator and self test.

This chapter contains information on how to load and run the automated adjustments, front panel emulation program, and calibration constants utility. These tests require operator interaction.

This software requires that the synthesizer is set to the TMSL programming language. This is set by the rear panel switch. Refer to "Setting Up the System" in this chapter for more information.

This chapter contains the following information on using the software:

- Setting Up the System.
- Installing the Software.
- Running the Software.
- Reporting Software Bugs.
- Automated Adjustments.
  - YO Delay Adjustment.
  - ADC Adjustment.
  - Power Flatness Adjustment.
- Utilities.
- Front Panel Emulation.
- Calibration Constants.
- Self-Test.
- Software Support Request.

Setting Up the System

Hardware Requirements

The automated tests require an HP 9000 series 200/300 desktop computer with at least 2.25 megabytes of RAM, a disk drive, and an HP-IB interface. This program will not run with high resolution color monitors (> 512 x 390 pixels). Software is provided on 3.5 inch disks, formatted double-sided, and are usable in double-sided disk drives only. If you require single-sided disks, see "Double- to Single-Sided Disk Conversion" under "Installing the Software" in this chapter. Any required measurement instruments are listed in each test procedure.

Operating System Requirements

The test software requires BASIC version 5.1 and the following binaries.

Table 5-1. Required Binaries

Language Extensions	Drivers
CLOCK	CRTA or CRTB (depends on CRT)
COMPLEX	CS80 or DISC (depends on disk)
CRTX	HFS
EDIT	HPIB
ERR	SRM
GRAPH	
GRAPHX	
IO	
KBD	
MAT	
MS	
PDEV	
TRANS	
XREF	

Refer to the BASIC user's documentation for instructions on loading the operating system and binaries.

Setting the TMSL Programming Language

The synthesizer is set to analyzer language when used in an HP 8510 system. When running automated tests or utilities, the synthesizer must be set to the TMSL programming language using the rear panel HP-IB switch. See Figure 5-1 and set the synthesizer to TMSL now.

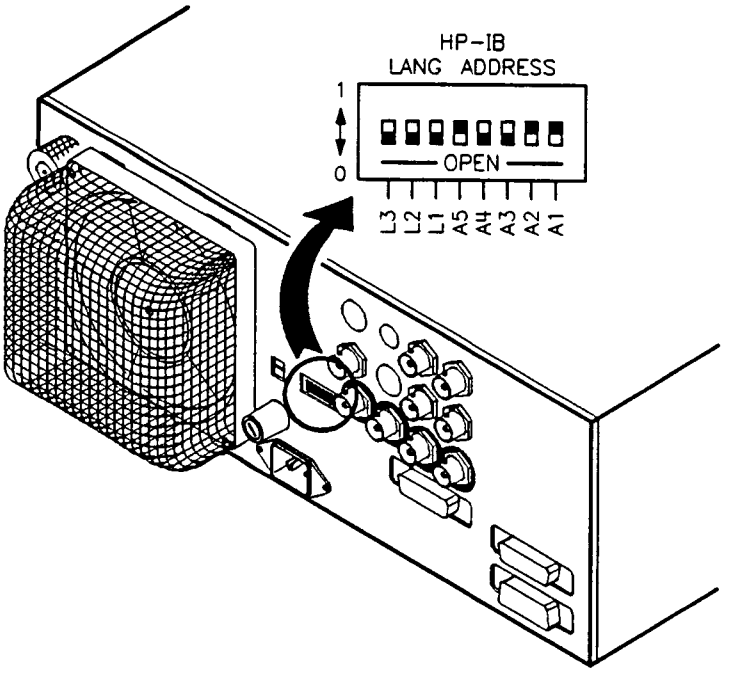


Figure 5-1. HP-IB Switch with TMSL Setting

Remember to set the HP-IB switch back to analyzer language (with address 19) when the synthesizer is installed in an HP 8510 system.

That binary setting is: 00110011

Installing the Software

Disk Files

The automated tests are provided on two double-sided disks. Both disks are required for the software to operate properly.

Make Working Copies

Before doing anything else, make working copies of the two master disks! When making working copies, do not split up the files contained on Disk 1. These must all reside on the same mass storage medium. The files on Disk 2 must also reside together.

Note When copying onto another 3.5 inch, double-sided disk, you must specify the interleave factor to be used during initialization of your blank disk. The required interleave factor is 2.

The master disks are shipped from the factory write-protected and cannot be written to or initialized in this mode. We recommend you maintain these master disks in write-protect mode. During execution of some tests, the program reads from and writes to one of the disks, use a working copy that is not write-protected when you run the software.

Installing the Program Onto a Hard Disk

We recommend that you run the software from a hard disk. It is possible to operate it from a single or dual floppy disk drive, however speed will be sacrificed.

To install the program onto your hard disk, create a directory that will contain the program and its associated files. (Refer to the BASIC user's documentation for instructions on creating directories.) After you create the directory, run the install program below to load all of the files onto your hard disk.

1. Insert Disk 2.
2. In the directory created, type: LOAD "INST_OPV" and press (RETURN).
3. Press (RUN) and follow the prompts.

Your hard disk is now set up to run the automated tests.

Operating From a Floppy Disk

When you run the software from a floppy disk drive, first load the program from Disk 1 when instructed to do so in "Loading the Software." Then insert Disk 2 and leave it in the disk drive while the program runs. If this is not done, the program will not run.

Double-to Single-Sided Disk Conversion

If you require a single-sided disk, the master disks can be converted to single-sided format using a double-sided disk drive. Use the following procedure to make the conversion. Press [RETURN] after each command. For information on formatting a single-sided disk on a double-sided drive, refer to the BASIC user's documentation.

1. Insert Disk 1 into the disk drive.
2. Set the default mass storage to the drive containing the disk. Type:

   ```
   LOAD "OPV_8360"
   DEL label_1, 32000
   ```

3. Remove the disk and insert a single-sided, formatted disk into the same drive (Disk 1A). Type:

   ```
   STORE "8360_1A"
   ```

4. Remove the disk and insert the original disk. Type:

   ```
   LOAD "OPV_8360"
   DEL label_2, 32000
   DEL 1, label_1
   ```

5. Remove the disk and insert another single-sided, formatted disk into the same drive (Disk 1B). Type:

   ```
   STORE "8360_1B"
   ```

6. Remove the disk and insert the original disk. Type:

   ```
   LOAD "OPV_8360"
   DEL 1,label_2
   ```

7. Remove the disk and insert another single-sided, formatted disk into the same drive (Disk 1C). Type:

   STORE "8360_1C"

8. Remove the disk and insert the original Disk 2. Type:

   LOAD "COPY_DISK2"
   Press (RUN).

Running the Software

Caution



This software uses RAM memory volumes for fast access of data files. These volumes may also be used by other programs and could contain data that will be erased by this program. Make sure that the computer you are using does not have important data in any memory volumes before running this software.

Configuration Limitations

The computer containing the software must be the *only* controller on the bus. If more than one controller is present, the software will not run properly.

Loading the Software

1. Make sure the software has been copied into a directory (if running from a hard disk) or copied to a work disk (if running from a floppy disk).
2. Set the default mass storage to the directory or floppy disk that contains the test software. Use the BASIC MSI command. See the BASIC *Language Reference* for more information on setting the default mass storage.

NOTE: CAPS LOCK ON or OFF cannot be changed while the program is running. Set the keyboard before you load the software.

3. Load the test software.

Insert Disk 1 in your default drive, or from your hard-drive directory, perform the following: (for single-sided formatted disks, see "Loading Single-Sided Disks"). Type:

LOAD "OPV_8360"
Press (RETURN).

4. When the drive light turns off, (if running off of a floppy disk, insert Disk 2 into the default drive) press (RUN) to start the test program.
5. The program displays a menu with the available model numbers. Using the arrow keys, select the correct model to be tested. Press (RETURN).
6. The program asks for the installed options and the serial number of the unit under test. Enter the appropriate information.
7. A menu of the available tests is displayed. Using the arrow keys, select the appropriate test. Press (RETURN).

Note Refer to the following pages for a detailed description and specific operating information (if any) for a specific test.

8. Follow the prompts in the individual tests for connection instructions and other relevant test information. When the test finishes, you are returned to the test menu.
9. Either select another test to run or select the QUIT softkey to exit the program.

Loading Single-Sided Formatted Disks

Use the following steps to load single-sided disks. Press (RETURN) after each command.

1. Insert Disk 1A into your default drive. Type:

   LOAD "8360_1A"

2. Remove Disk 1A and insert Disk 1B. Type:

   LOADSUB ALL FROM "8360_1B"

3. Remove Disk 1B and insert Disk 1C. Type:

   LOADSUB ALL FROM "8360_1C"

4. Remove Disk 1C and insert Disk 2. Press (RUN).

In Case of Difficulty

1. Re-cycle the synthesizer main power.
2. Make sure the HP-IB address switch is set to TMSL programming language. For more information, refer to "Setting the TMSL Programming Language" in this chapter.

Reporting Software Bugs

If a test does not run correctly, re-run the test. If the test fails to run properly again, fill out the "Software Support Request" at the end of this chapter and return it to your local HP sales office.

1. YO Delay Adjustment

Description

This adjustment uses the internal counter to measure swept frequency accuracy. YO Delay affects the swept frequency accuracy at fast sweep times (less than 100 ms). This procedure adjusts the calibration constants for the YIG oscillator to achieve consistent swept frequency accuracy over the entire operating range of the instrument.

Select the YO delay adjustment and follow the prompts on the display.

No test equipment is required.

2. ADC Adjustment

Description

This adjustment uses an external digital voltmeter (DVM) to measure VCOMP on the YO driver assembly and compares the reading to the ADC measurement. The ADC calibration constants are adjusted so that the DVM and ADC measurements are the same. The procedure is repeated for each voltage range (both plus and minus supplies).

Select the ADC adjustment and follow the prompts on the display.

The following test equipment is required for this adjustment. (The test setup is given in the software.)

Test Equipment Required

Instrument	HP Model Number
Digital Voltmeter	3456A, 3457A, or 3458A

3. Power Flatness Adjustment

Description

The test is provided as a softkey on the front panel, but cannot be run by the front panel emulation program because of it's interaction with the power meter.

This adjustment zeros the digital ALC array and measures the power from the RF output. The power is measured every 10 MHz in low band and every 100 MHz in high and millimeter bands. The calibration constants are adjusted to achieve a flat output.

The calibration factors for the power sensor must be added to the program.

The following test equipment is required for this adjustment. No substitutions are allowed. (The test setup is given in the software.)

Test Equipment Required

Instrument	HP Model Number
Power Meter	438A
Power Sensor (100 kHz to 4.2 GHz)	8482A
Power Sensor (50 MHz to 26.5 GHz)	8485A
Power Sensor (50 MHz to 50 GHz)[1]	8487A

1 For 50 GHz synthesizers only.

Procedure

Select the power flatness adjustment and enter your power sensor data by following the steps below.

Note: If the power sensor data was added previously, and is still current, skip the following steps and run the test.

1. Select the HELP softkey to access the power sensor configuration and calibration menus.
2. Select power meter configuration.

3. Select the sensor to edit.
4. Enter the power sensor configuration data (follow the prompts on the display).

Note: Do *not* edit the "Sensor ID". The names set at the factory must remain unchanged for the program to run properly. The factory recommended "Zero Hr" is 1.00 and the "Cal Hr" is 24.00. Use the left and right arrows to move the cursor within a field and the up and down arrows to increment or decrement the value. [RETURN] selects the field.

5. When all changes have been made, select save power meter configuration.
6. Next select power meter calibration factors to add the power sensor calibration factors to the program.
7. Select current to change the active power sensor to the one for which you would like to enter the data.
8. Select edit header and enter the serial numbers of the power sensor.
9. Select edit calibration factors.
10. Enter the calibration factors from your power sensor (follow the prompts on the display).
11. When all of the calibration factors have been added, select store calibration factors to store the calibration factors for future use.
12. Exit the power meter calibration.
13. Run the power flatness adjustment.

Utilities

1. Front Panel Emulation

Description

This utility simulates an 8360 series instrument front panel keyboard in an instrument with a delete front panel option installed.

Procedure

Be sure that the HP-IB switch on the synthesizer rear panel is set to TMSL programming language. For more information, refer to "Setting the TMSL Programming Language" in this chapter.

To access the front panel emulation utility, select the front panel emulation program in the test menu.

The front panel emulation program cannot run front panel functions that use a power meter or printer. These functions cause the 8360 series instrument to act as a controller, which conflicts with the computer as the controller on the bus. Use a substitute front panel to run these functions, or use the tests provided with this software.

When using the front panel emulation program, enter the letter directly above the caret (^) to activate the function or key. Note that the keys are case sensitive ("L" means "ALC" and "l" means "LOCAL"). See Table 5-2 for a detailed listing of hardkey designations.

For numeric entry, two different terminator keys are combined on one hardkey. The actual terminator depends on the active mode of the synthesizer.

For example: When pulse width is the active entry, [10] [k] enters 10 ms. When frequency span is the active entry, [10] [k] enters 10 kHz.

Softkeys are designated by `menukey X`, where X is 1 through 5 and corresponds to the five softkey positions below the display. To activate the softkey, press

the function key on the keyboard that corresponds to the number X indicated by menukey.

Table 5-2. Synthesizer Hardkey Emulation

Hardkey	Program Display	To Activate Select
MENU SELECT		
[MOD]	mod	m
[ALC]	aLc	L
[MARKER]	mrK	K
[USER CAL]	cal	c
[SERVICE]	Srv	S
[PRIOR]	Prior	P
SYSTEM		
[SAVE]	saVe	V
[RECALL]	Rcl	R
[MENU]	meNu	N
USER DEFINED		
[MENU]	menU	U
[ASSIGN]	asgn	a
ENTRY		
[ENTRY ON/OFF]	entry off	f
[GHz/dB(m)]	GHz/dBm	G
[MHz/usec]	MHz/uS	M
[kHz/msec]	kHz/mS	k
[Hz,sec/ENTER]	Hz/ENT	H

Table 5-2. Synthesizer Hardkey Emulation (continued)

Hardkey	Program Display	To Activate Select
SWEEP		
[SWEEP TIME]	Time	T
[SINGLE]	sIng	I
[CONT]	cOnt	O
[MENU]	mEnu	E
FREQUENCY		
[CW]	cW	W
[START]	stArt	A
[STOP]	stop	o
[CENTER]	Cent	C
[SPAN]	span	n
[MENU]	menu	u
POWER		
[POWER LEVEL]	level	v
[FLTNESS ON/OFF]	flat	t
[RF ON/OFF]	on/oFf	F
[MENU]	menu	e
INSTRUMENT STATE		
[PRESET]	preset	r
[LOCAL]	local	l

2. Calibration Constants

Description

The calibration constants utility provides a variety of ways to manipulate the calibration constants stored in the instrument.

Use this utility to print out a list of the calibration constants stored in the instrument, to make a back-up of the calibration constants, and to restore calibration constants from a backed-up file.

Procedure

Enter the password to allow access to the calibration constants by running the front panel emulation program provided with this software. See the "Calibration Constants" tab in this manual for information on accessing the calibration constants with the password.

You may need to perform several steps to reach your final goal. For example, to move the calibration constants from the instrument's working memory to a disk for back-up, you must first move them to the computer memory, and then from computer memory to disk. To store the calibration constants, you may use the hard disk drive, Disk 2 of your working disks, or a separate data disk. When storing data on a new disk, be sure to format the disk before you begin the utility.

Select the calibration constants entry in the test menu and follow the prompts.

3. Self-test

Description

This utility is executed using the front panel emulation program. A full self-test of the synthesizer will be executed and the results displayed on the computer.

HEWLETT PACKARD **INSTRUMENT SYSTEM**

Software Support Request

SUBMITTED BY (SYSTEM MANAGER)	PHONE EXTENSION	DATE	CUSTOMER REFERENCE #
COMPANY NAME	SYSTEM MODEL	SERIAL #	

DEPARTMENT/DIVISION/BUILDING	SOFTWARE PRODUCT INFORMATION	NAME
ADDRESS		NUMBER
		REVISION CODE

CONFIGURATION (Include the minimum hardware, software and firmware on which the problem occurs. This should include applicable options, date code and revision, etc.)

PROBLEM DESCRIPTION (Include environment, symptom, what you were trying to do, what went wrong, and any other information that might be helfpul.)

DOCUMENTATION (List all the supportive documentation included with this report. You must provide all relevant programs, data lines, data bases, etc. Please label the media.)

MEDIA	DESCRIPTION
_____	_____
_____	_____
_____	_____

Return this form to your local HP Sales Office, Attn: Instrument SEDM

HEWLETT PACKARD **INSTRUMENT SYSTEM**

SSR #

Software Support Request Verification

To be completed by the local HP Systems Engineer

Verified by	COMSYS Code	Date	Sales Office Reference #	Phone Extension

Severity Level:
☐ Critical ☐ Serious ☐ Normal ☐ Low

product name

Classification:
☐ Enhancement Request ☐ New Problem

product number | revision | uu ff

Category:
☐ software ☐ diagnostic ☐ hardware ☐ unknown ☐ firmware ☐ documentation

Detailed instructions for duplicating:

Workaround:

Time spent verifying this request: _____ . ____ hours

Directions to S.E.:

1. *Send this form along with any backup material to the system manufacturing division's Support Manager.*
2. *Send a copy of this form to ISD-Mountain View, QA Manager.*

For HP Use Only

HEWLETT PACKARD **INSTRUMENT SYSTEM**

Software Support Request

SUBMITTED BY (SYSTEM MANAGER)	PHONE EXTENSION	DATE	CUSTOMER REFERENCE #
COMPANY NAME	SYSTEM MODEL	SERIAL #	
DEPARTMENT/DIVISION/BUILDING	SOFTWARE PRODUCT INFORMATION	NAME	
ADDRESS		NUMBER	
		REVISION CODE	

CONFIGURATION (Include the minimum hardware, software and firmware on which the problem occurs. This should include applicable options, date code and revision, etc.)

PROBLEM DESCRIPTION (Include environment, symptom, what you were trying to do, what went wrong, and any other information that might be helfpul.)

DOCUMENTATION (List all the supportive documentation included with this report. You must provide all relevant programs, data lines, data bases, etc. Please label the media.)

MEDIA	DESCRIPTION
_____	_____
_____	_____
_____	_____

Return this form to your local HP Sales Office, Attn: Instrument SEDM

HEWLETT PACKARD **INSTRUMENT SYSTEM**

SSR #

Software Support Request Verification

To be completed by the local HP Systems Engineer

Verified by	COMSYS Code	Date	Sales Office Reference #	Phone Extension

Severity Level: ☐ Critical ☐ Serious ☐ Normal ☐ Low	product name		
Classification: ☐ Enhancement Request ☐ New Problem	product number	revision	uu ff

Category:

☐ software ☐ diagnostic ☐ hardware ☐ unknown ☐ firmware ☐ documentation

Detailed instructions for duplicating:

Workaround:

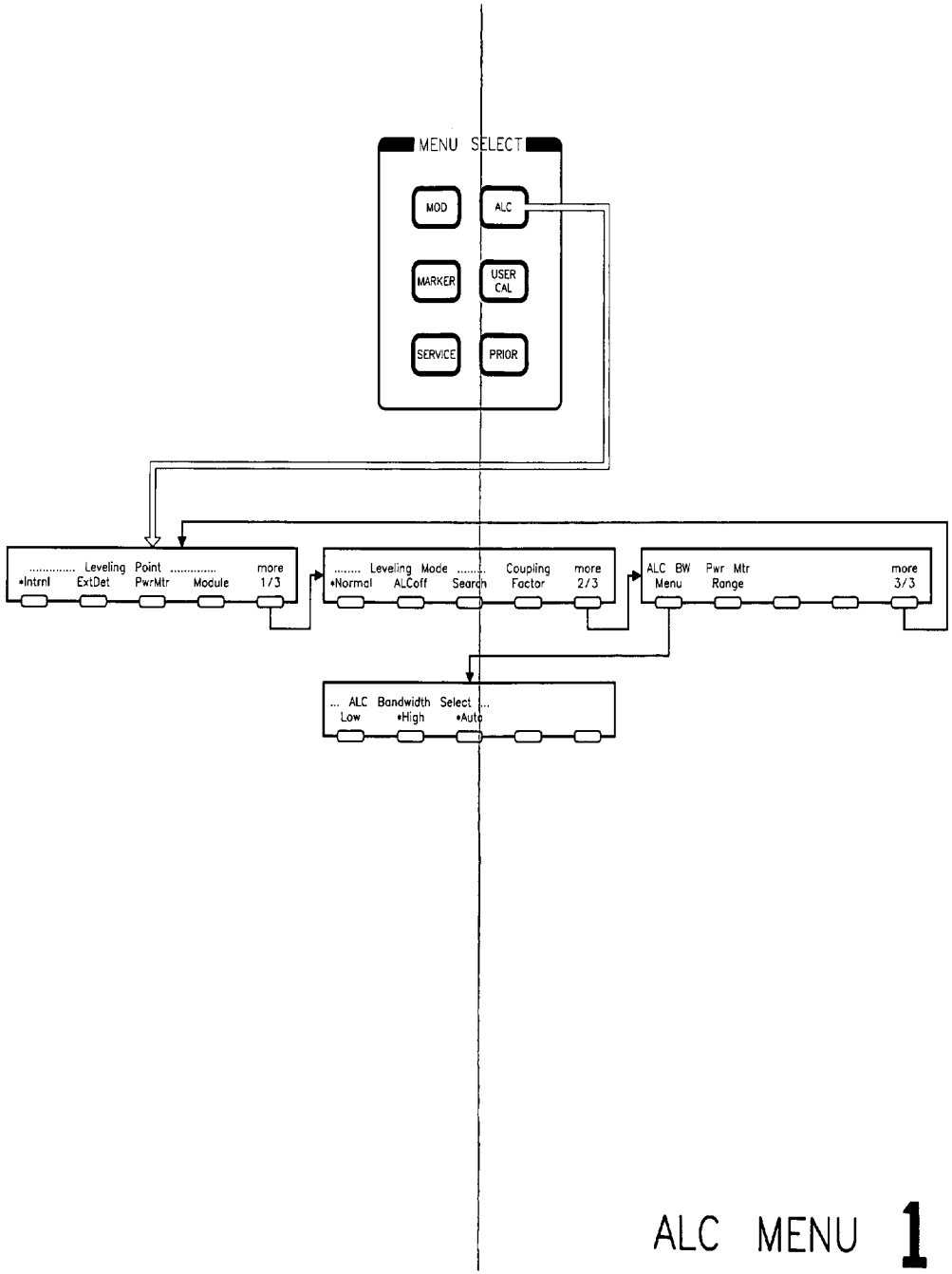
Time spent verifying this request: _____ . ____ hours

Directions to S.E.:

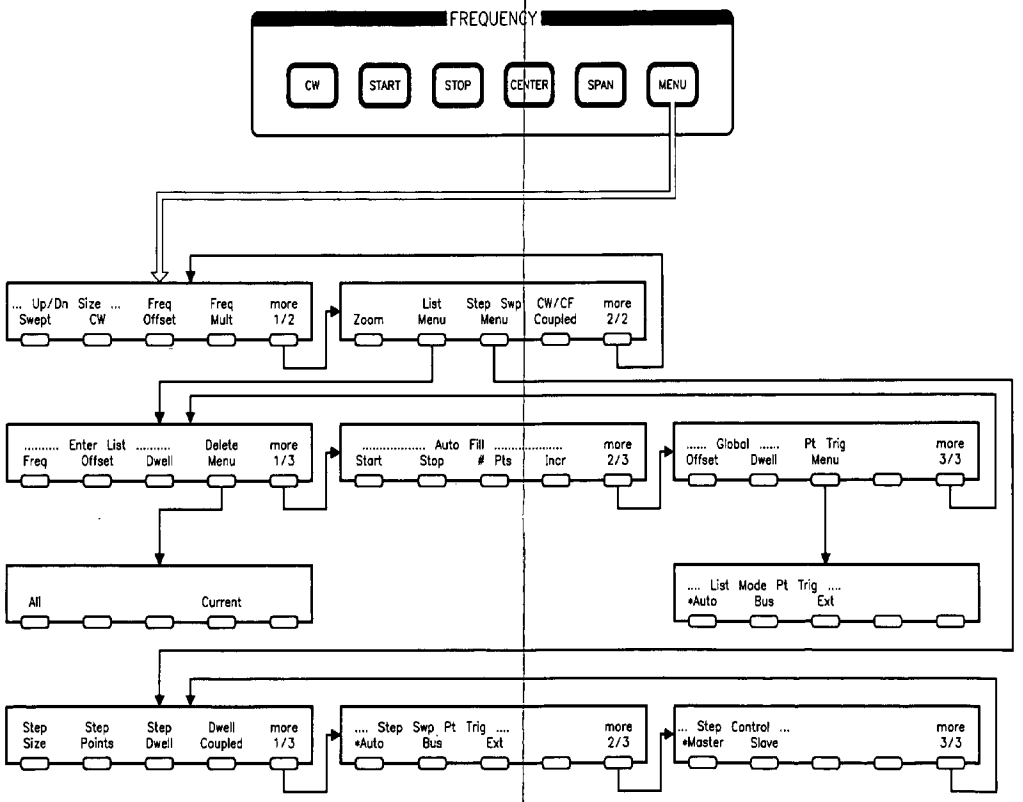
1. *Send this form along with any backup material to the system manufacturing division's Support Manager.*
2. *Send a copy of this form to ISD-Mountain View, QA Manager.*

For HP Use Only

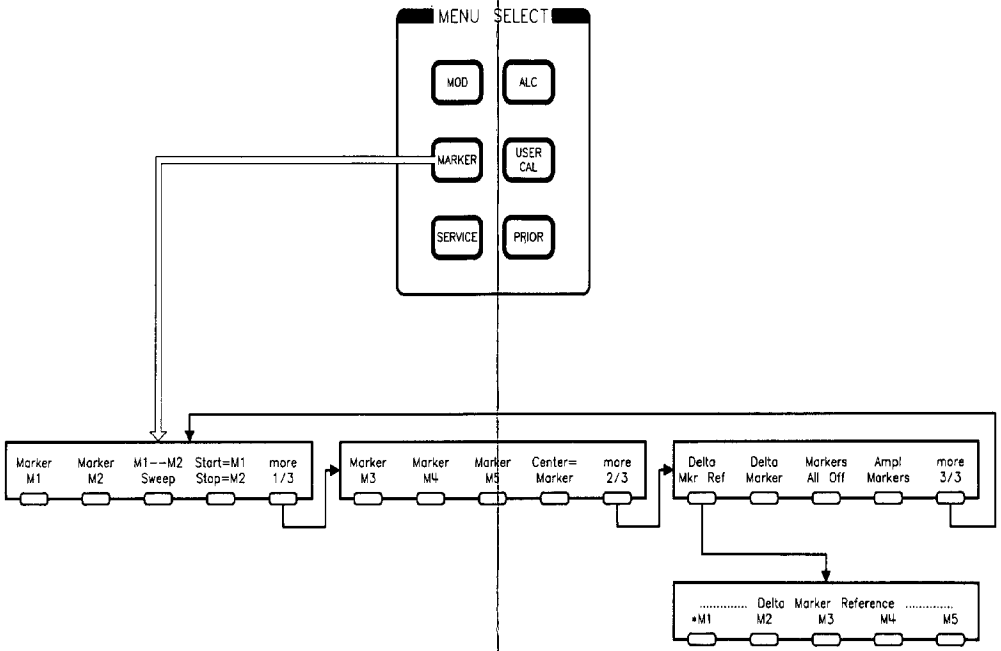
6 MENU MAPS


MENU SELECT
MOD
ALC
MARKER
USER CAL
SERVICE
PRIOR
..... Leveling Point ..... more
•Intrnl ExtDet PwrMtr Module 1/3
..... Leveling Mode ..... Coupling more
•Normal ALCoff Search Factor 2/3
ALC BW Pwr Mtr more
Menu Range 3/3
... ALC Bandwidth Select ...
Low •High •Auto

ALC MENU 1

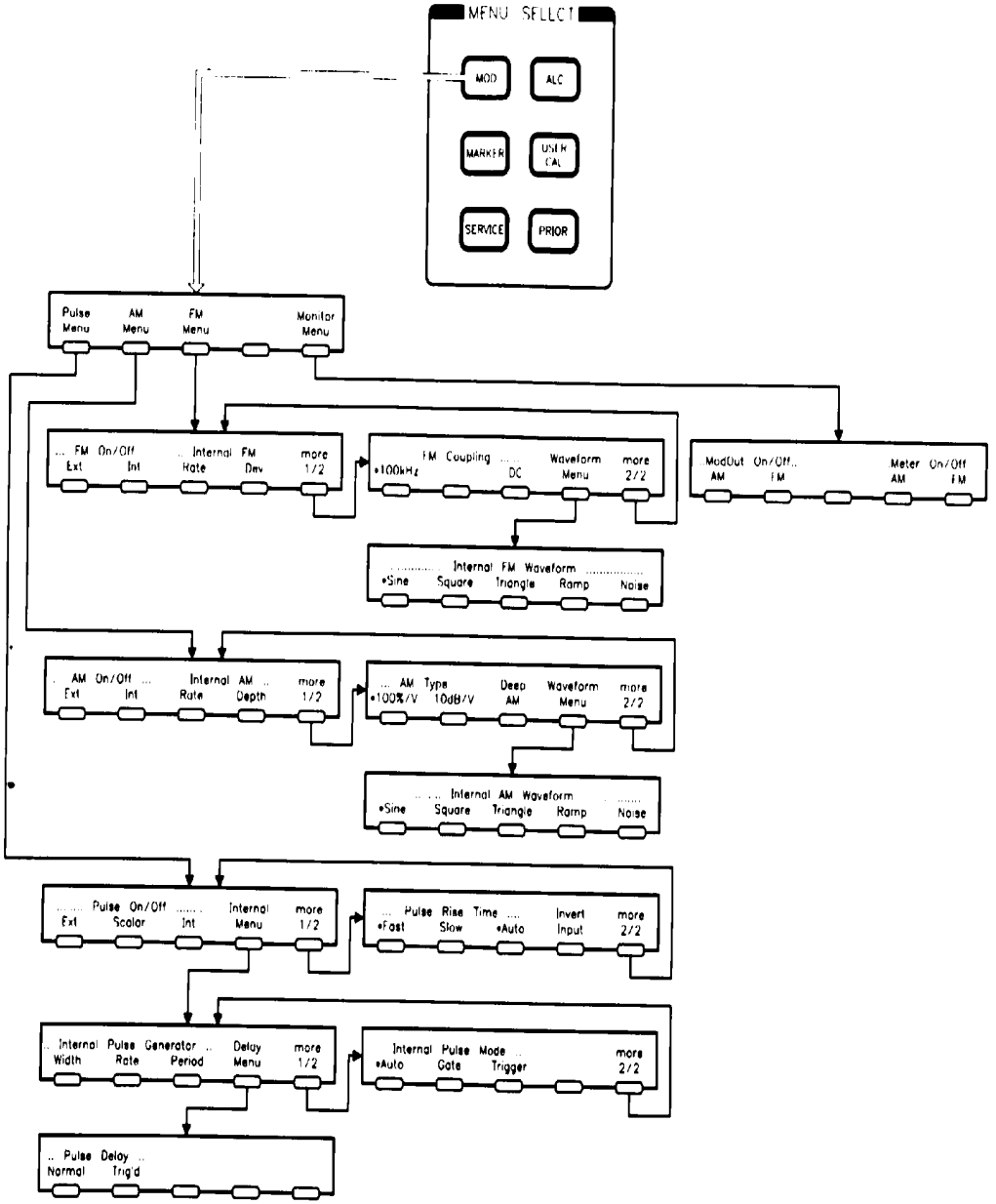


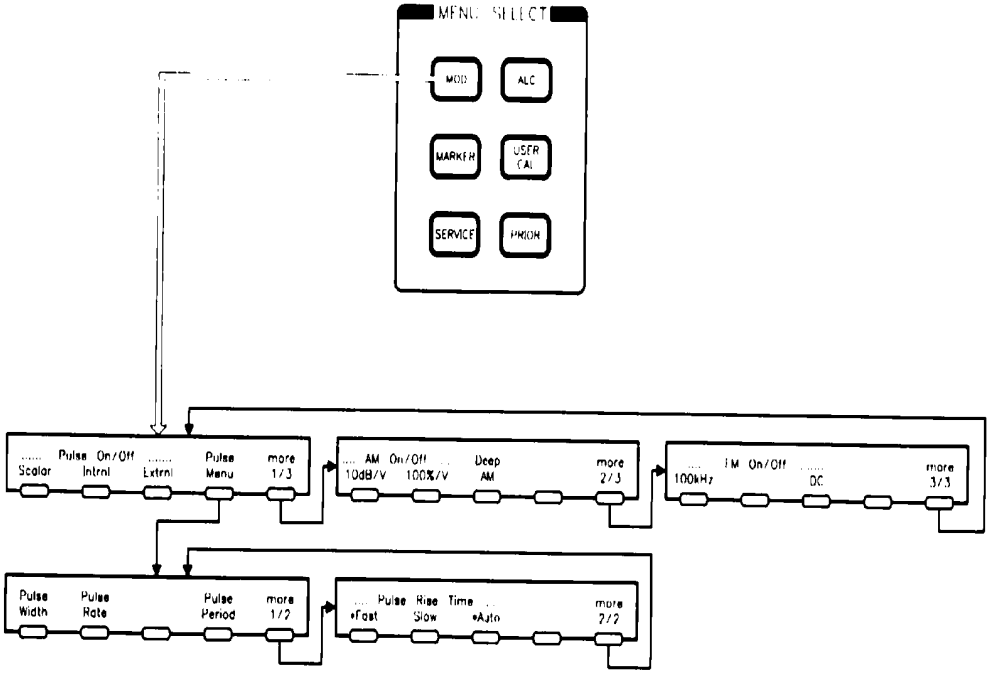
FREQUENCY MENU 2

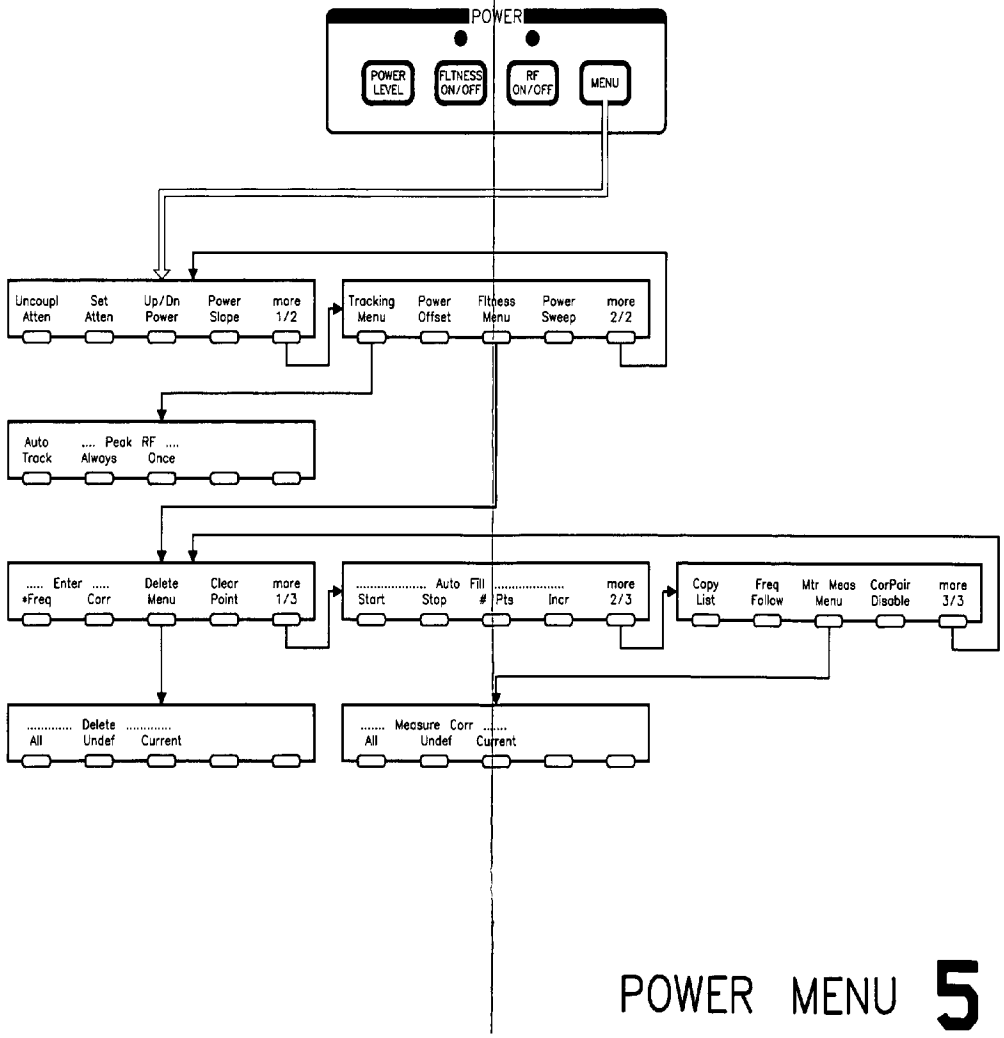


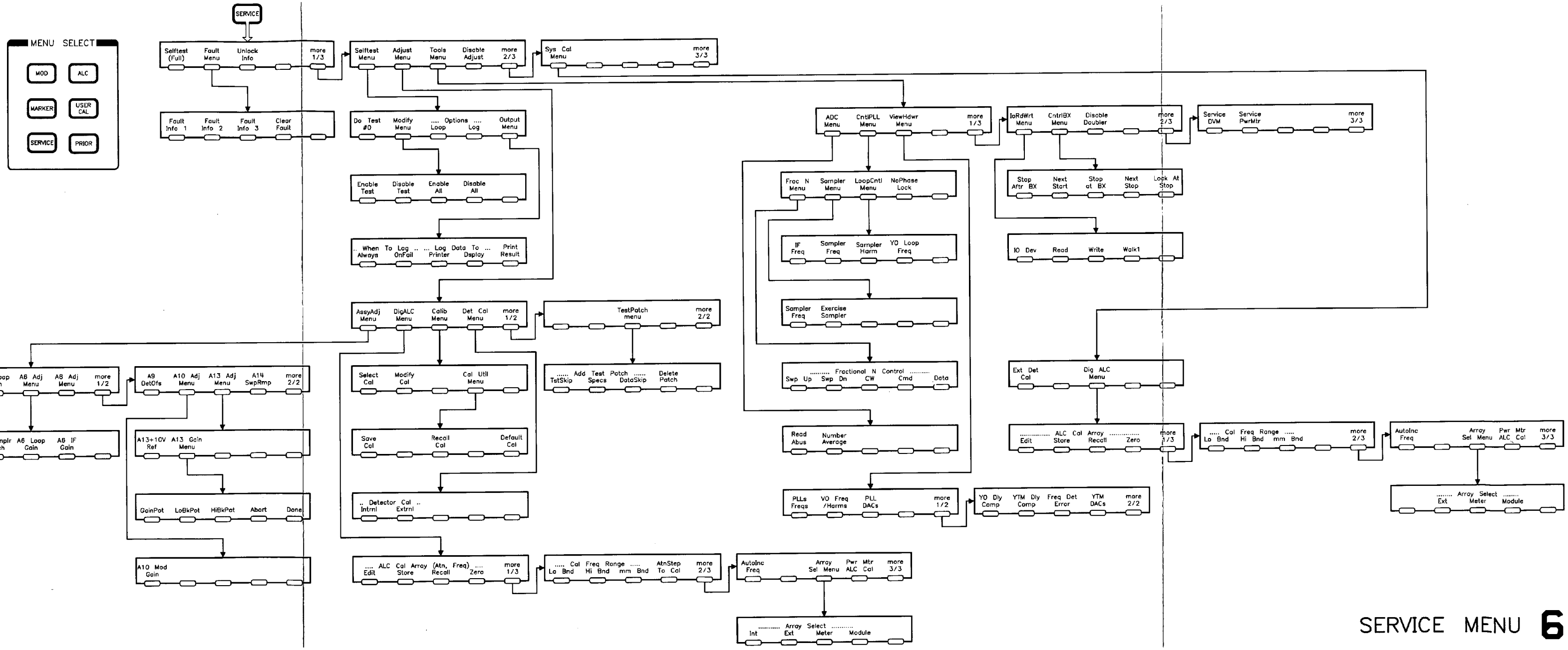
MARKER MENU 3

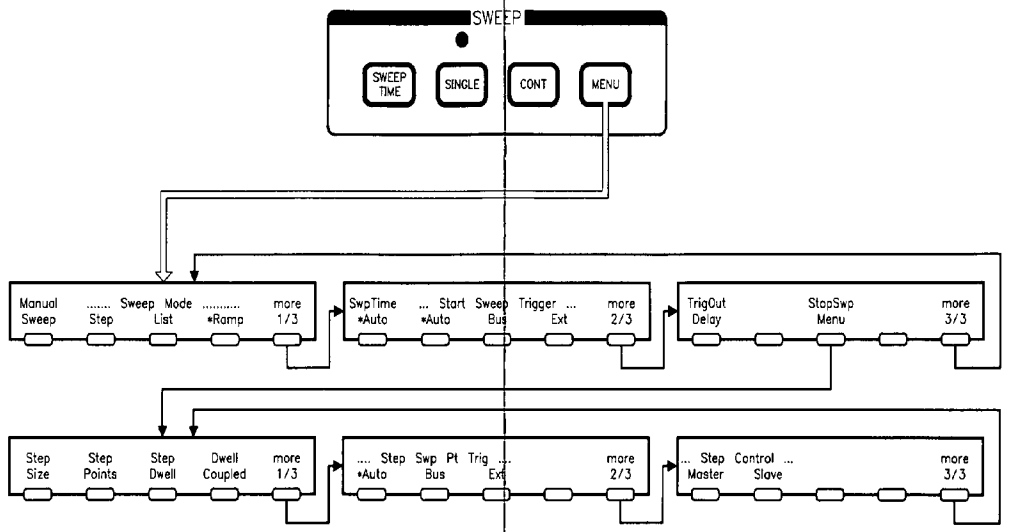
OPTION 002 MENU



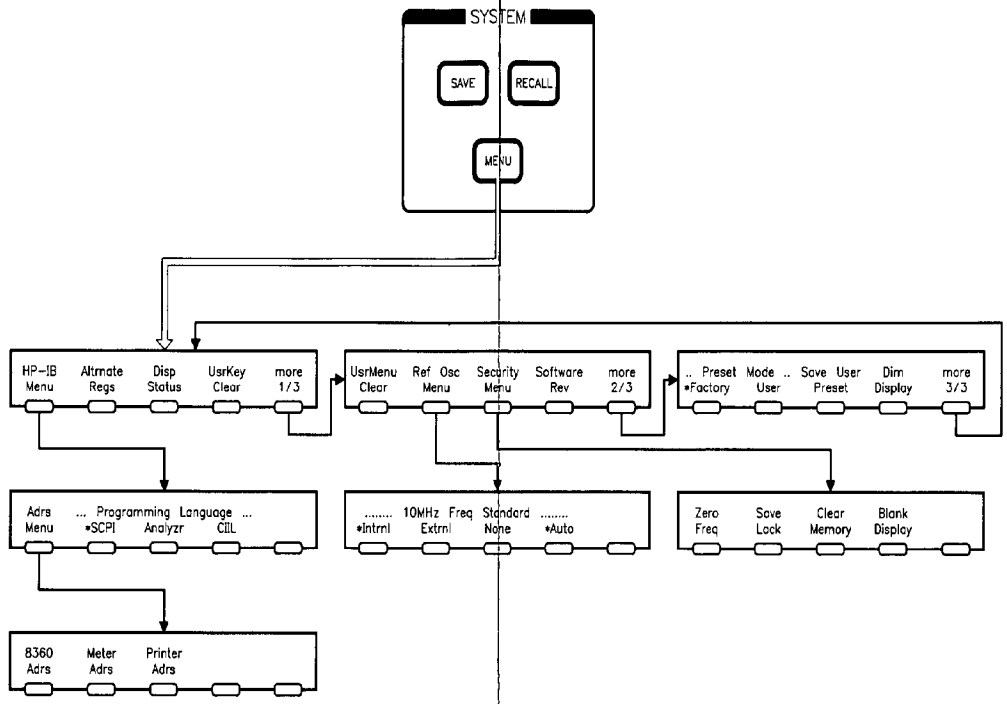


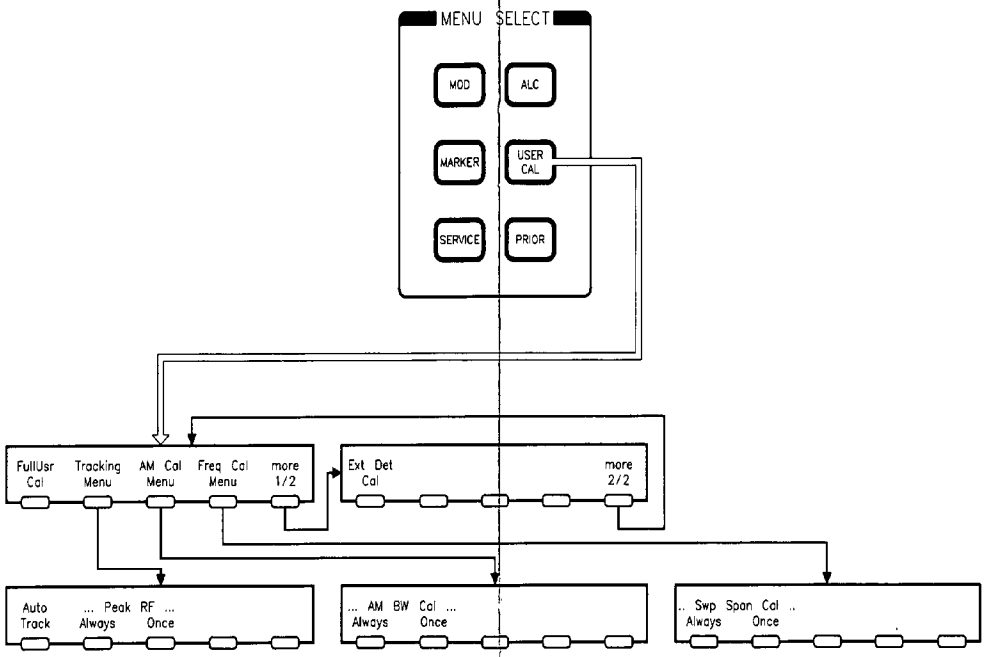

POWER
POWER LEVEL
FLTNESS ON/OFF
RF ON/OFF
MENU
Uncoupl Atten
Set Atten
Up/Dn Power
Power Slope
more 1/2
Tracking Menu
Power Offset
Fltness Menu
Power Sweep
more 2/2
Auto Track
.... Peak RF ....
Always
Once
..... Enter .....
*Freq
Corr
Delete Menu
Clear Point
more 1/3
..... Auto Fill .....
Start
Stop
Pts
Incr
more 2/3
Copy List
Freq Follow
Mtr Meas Menu
CorPair Disable
more 3/3
..... Delete .....
All
Undef
Current
..... Measure Corr .....
All
Undef
Current


MENU SELECT
MOD
ALC
MARKER
USER CAL
SERVICE
PRIOR
SERVICE
Selftest (Full)
Fault Menu
Unlock Info
more 1/3
Selftest Menu
Adjust Menu
Tools Menu
Disable Adjust
more 2/3
Sys Cal Menu
more 3/3
Fault Info 1
Fault Info 2
Fault Info 3
Clear Fault
Do Test #0
Modify Menu
.... Options .... Loop
Log
Output Menu
Enable Test
Disable Test
Enable All
Disable All
.. When To Log .. Always
... Log Data To ... OnFail
Printer
Display
Print Result
AssyAdj Menu
DigALC Menu
Calib Menu
Det Cal Menu
more 1/2
TestPatch menu
more 2/2
Select Cal
Modify Cal
Cal Util Menu
Save Cal
Recall Cal
Default Cal
.. Detector Cal .. Intrnl
Extrnl
TstSkip
Add Test Patch ..... Specs
DataSkip
Delete Patch
A4 VCO Tune
A5 Loop Gain
A6 Adj Menu
A8 Adj Menu
more 1/2
A9 DetOfs
A10 Adj Menu
A13 Adj Menu
A14 SwpRmp
more 2/2
A6 VCO Tune
A6 Smplr Match
A6 Loop Gain
A6 IF Gain
A13+10V Ref
A13 Gain Menu
GainPot
LoBkPot
HiBkPot
Abort
Done
A10 Mod Gain
.... ALC Cal Array (Atn, Freq) ... Edit
Store
Recall
Zero
more 1/3
..... Cal Freq Range ..... Lo Bnd
Hi Bnd
mm Bnd
AtnStep To Cal
more 2/3
AutoInc Freq
Array Sel Menu
Pwr Mtr ALC Cal
more 3/3
..... Array Select ..... Int
Ext
Meter
Module
ADC Menu
CntlPLL Menu
ViewHdwr Menu
more 1/3
Frac N Menu
Sampler Menu
LoopCntl Menu
NoPhase Lock
IF Freq
Sampler Freq
Sampler Harm
YO Loop Freq
Sampler Freq
Sampler Exercise
..... Fractional N Control ..... Swp Up
Swp Dn
CW
Cmd
Data
Read Abus
Number Average
PLLs Freqs
VO Freq /Harms
PLL DACs
more 1/2
YO Dly Comp
YTM Dly Comp
Freq Det Error
YTM DACs
more 2/2
IoRdWrt Menu
CntrlBX Menu
Disable Doubler
more 2/3
Stop Aftr BX
Next Start
Stop at BX
Next Stop
Lock At Stop
IO Dev
Read
Write
Walk1
Service DVM
Service PwrMtr
more 3/3
Ext Det Cal
Dig ALC Menu
..... ALC Cal Array ..... Edit
Store
Recall
Zero
more 1/3
..... Cal Freq Range ..... Lo Bnd
Hi Bnd
mm Bnd
more 2/3
AutoInc Freq
Array Sel Menu
Pwr Mtr ALC Cal
more 3/3
..... Array Select ..... Ext
Meter
Module


SWEEP
SWEEP TIME
SINGLE
CONT
MENU
Manual Sweep
..... Sweep Mode .....
Step
List
*Ramp
more 1/3
SwpTime *Auto
... Start Sweep Trigger ...
*Auto
Bus
Ext
more 2/3
TrigOut Delay
StopSwp Menu
more 3/3
Step Size
Step Points
Step Dwell
Dwell Coupled
more 1/3
.... Step Swp Pt Trig ....
*Auto
Bus
Ext
more 2/3
... Step Control ...
Master
Slave
more 3/3

SWEEP MENU 7


SYSTEM
SAVE
RECALL
MENU
HP-IB Menu
Alternate Regs
Disp Status
UsrKey Clear
more 1/3
UsrMenu Clear
Ref Osc Menu
Security Menu
Software Rev
more 2/3
.. Preset *Factory
Mode .. User
Save User Preset
Dim Display
more 3/3
Adrs Menu
... Programming Language ...
*SCPI
Analyzr
CIIL
..... 10MHz Freq Standard .....
*Intrnl
Extrnl
None
*Auto
Zero Freq
Save Lock
Clear Memory
Blank Display
8360 Adrs
Meter Adrs
Printer Adrs



USER CAL MENU 9

7

Disassembly and Replacement Procedures

Introduction

This chapter provides the following disassembly and reassembly procedures. Use these procedures while repairing or replacing an assembly.

- Front Panel Disassembly and Reassembly.
- Rear Panel Disassembly and Reassembly.
- RF Deck Disassembly and Reassembly.
- Motherboard Disassembly and Reassembly.

Warning



This instrument has been designed in accordance with international safety standards, however only a skilled person who is aware of the hazards involved should disassemble this instrument. Voltages in the instrument can, if contacted, cause personal injury; be extremely careful. Capacitors may be charged even if the instrument has been disconnected from line power.

Caution



Perform the following procedures only at a static safe work station. The attenuators and printed circuit assemblies in this instrument are very sensitive to static electricity damage. Wear an anti-static wrist strap that is connected to earth ground.

Caution



When reassembling the instrument, the cables shown in Figure 7-1 must be routed through the instrument *as shown* or instrument performance may be affected.

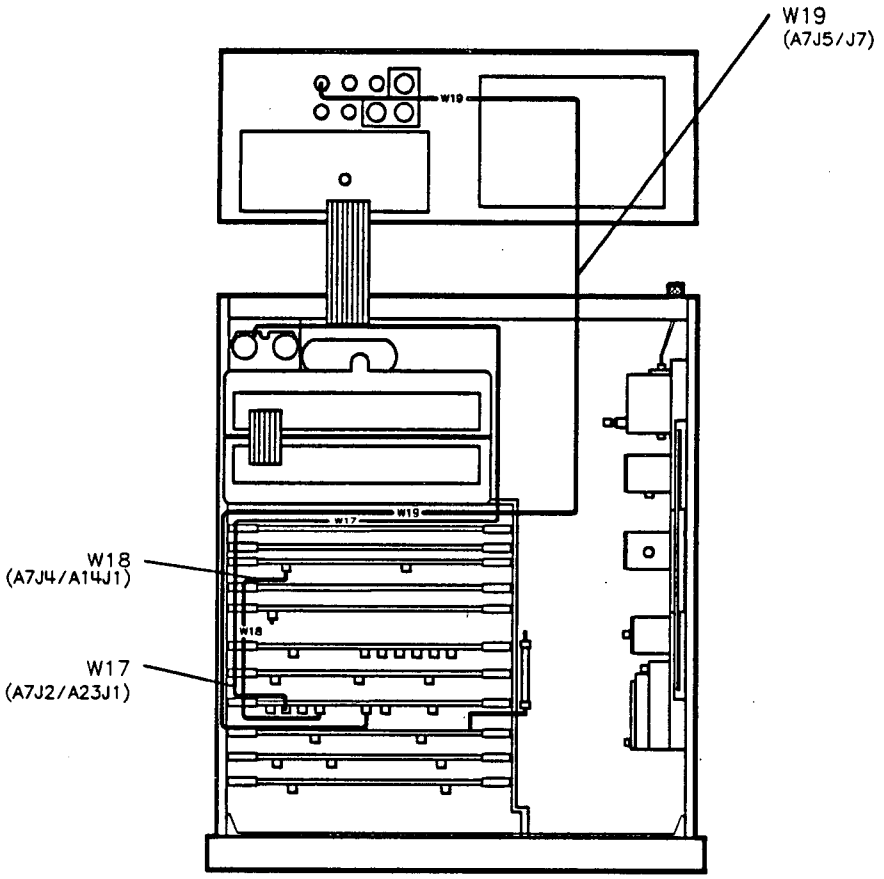


Figure 7-1. Cable Routing Locations

Tools Required

Each procedure lists the required tools at the beginning of that section. See the "Replaceable Parts" chapter for the associated part numbers.

Front Panel Disassembly and Reassembly

Tools Required

T-10 Torx Screwdriver (torque 10 in-lb).
0.050 Hex Driver.
9/16 in. Nut Driver.
5/16 in. Open End Wrench.
Coax Extractor Tool–Submin D Connector

Description and Procedure

To disassemble the front panel, follow this procedure in the order given.

To reassemble the front panel, follow this procedure in the reverse order.

Refer to the flowchart in Figure 7-2 to determine the necessary disassembly steps for a given assembly.

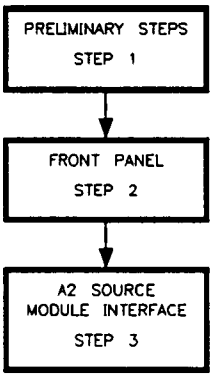


Figure 7-2. Front Panel Disassembly Flowchart

1. Preliminary Steps

Caution 

You can easily blow the fuse for the 13.5V supply on the preregulator assembly if you do not disconnect the AC power cord. Also, the danger of shock is increased if the power cord is connected.

1. Disconnect the AC power line cord.
2. Remove the screw from each of the top two feet on the rear panel.
3. Remove the top two feet.
4. Remove the instrument top cover.

Note: An RF braid is in each of the side channels on the top of the instrument. When you reassemble the instrument, be sure this braid remains in the channel.

5. Remove the vinyl trim strip from the top, front edge of the instrument. (Place a flat screwdriver in either slot in the trim strip and lift to remove, see Figure 7-3.)

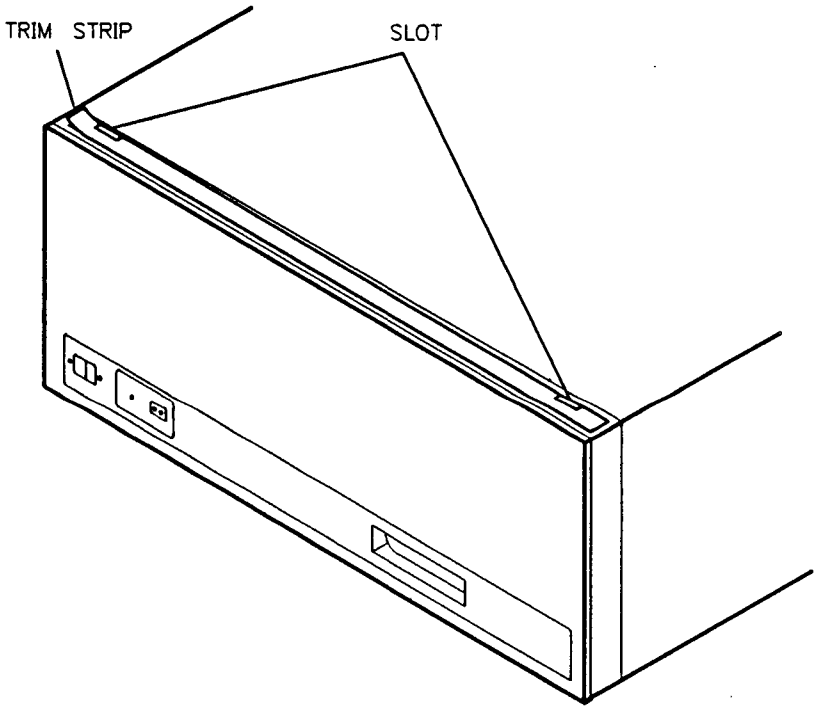


Figure 7-3. Front Edge Trim Strip

2. Front Panel Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-4.

1. Remove *three* of the four screws under the trim strip.
2. Remove *two* of the three screws on the lower, front frame edge.
3. Gently pry the front panel and display from the frame.

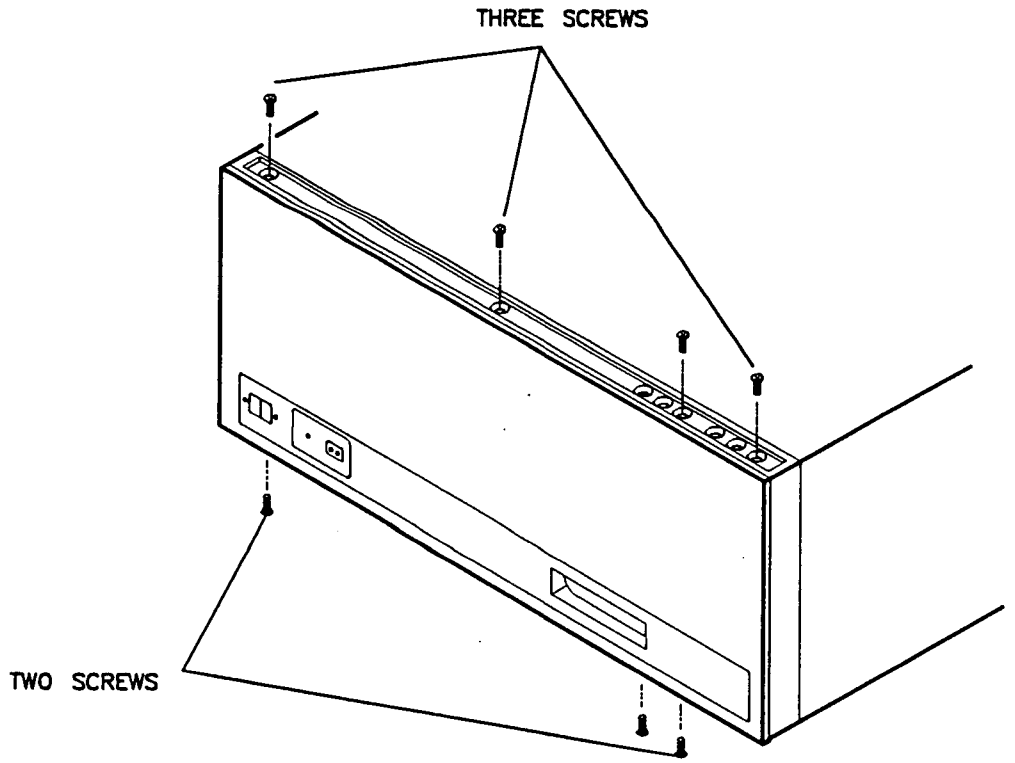


Figure 7-4. Front Panel Screw Locations

Refer to Figure 7-5.

4. Disconnect coaxial cable W10 at the A10J2 SMB connection on the A10 ALC board assembly. Disconnect ribbon cable W2 at the A22J1 connector on the A22 motherboard assembly.

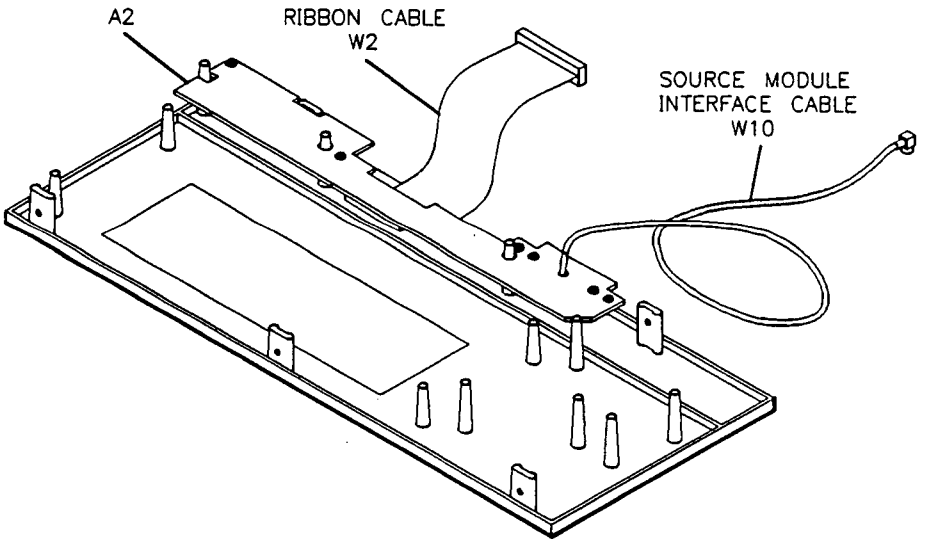


Figure 7-5. Front Panel Coaxial and Ribbon Cable Locations

3. A2 Source Module Interface Removal

Note: Complete "Preliminary Steps" and "Front Panel Removal" before continuing.

Refer to Figure 7-6.

1. Remove the source module interface cable (W10).
2. Remove the four screws.
3. Remove the source module interface assembly.
4. Disconnect ribbon cable W2 from the source module interface assembly.
5. Remove the A2 source module interface assembly.

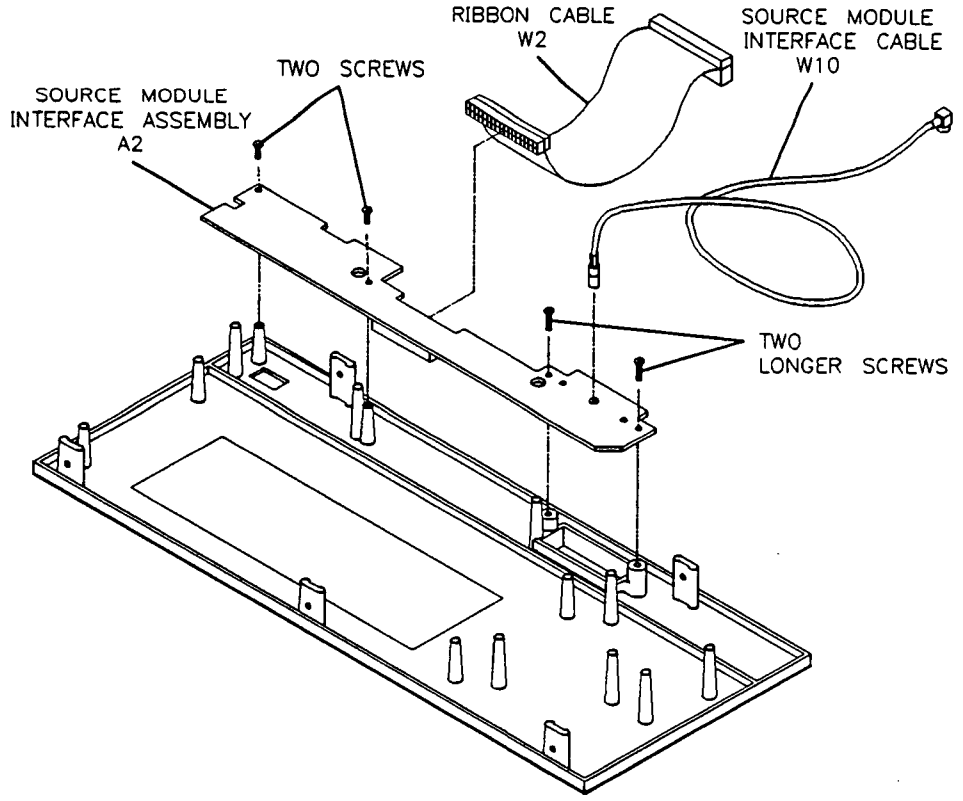


Figure 7-6. Source Module Interface Removal

Rear Panel Disassembly and Reassembly

Tools Required

9/16 in. Socket
T-10 Torx Screwdriver
T-15 Torx Screwdriver
5.5 mm Nut Driver
5/16 in. Open End Wrench
14 mm Open End Wrench
7 mm Nut Driver
#1 x 3 1/8 in. Pozidriv Screwdriver
#2 x 4 in. Pozidriv Screwdriver
Coax Extractor Tool–Submin D Connector

Description and Procedure

To disassemble the rear panel and associated assemblies, follow this procedure in the order given.

To reassemble the rear panel and associated assemblies, follow this procedure in the reverse order.

Caution Cable routing may affect instrument performance. Refer to Figure 7-1 for a diagram of the instrument cable routing.

Refer to the flowchart in Figure 7-7 to determine the necessary disassembly steps for a given assembly.

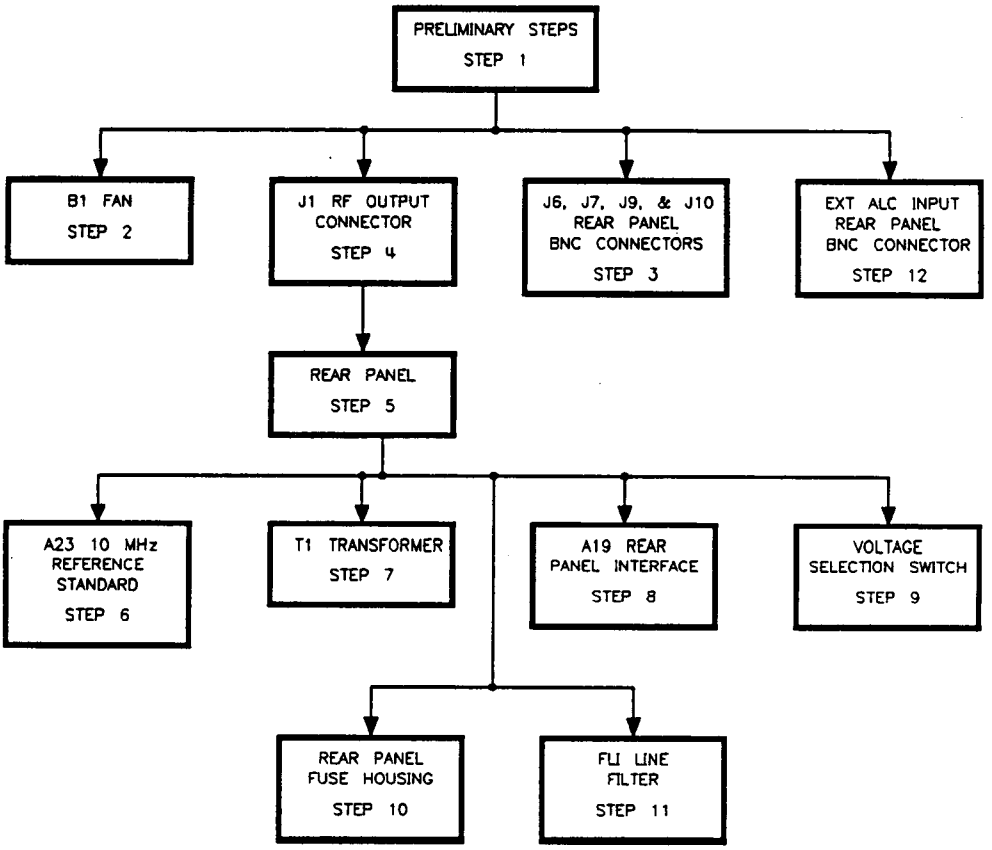


Figure 7-7. Rear Panel Disassembly Flowchart

1. Preliminary Steps

Caution



You can easily blow the fuse for the 13.5V supply on the preregulator assembly if you do not disconnect the AC power cord. Also, the danger of shock is increased if the power cord is connected.

1. Disconnect the AC power line cord.
2. Remove the screw from each of the four feet on the rear panel.
3. Remove the four feet.
4. To remove the side straps, remove the two screws on each side panel.
5. Remove the instrument top, bottom, and side covers.

Note: An RF braid is in each of the side channels on the top and bottom of the instrument. When you reassemble the instrument, be sure the braids remain in the side cover channels.

2. B1 Fan Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-8.

1. Remove the two fan cage screws.
2. Remove the fan cage and filter.

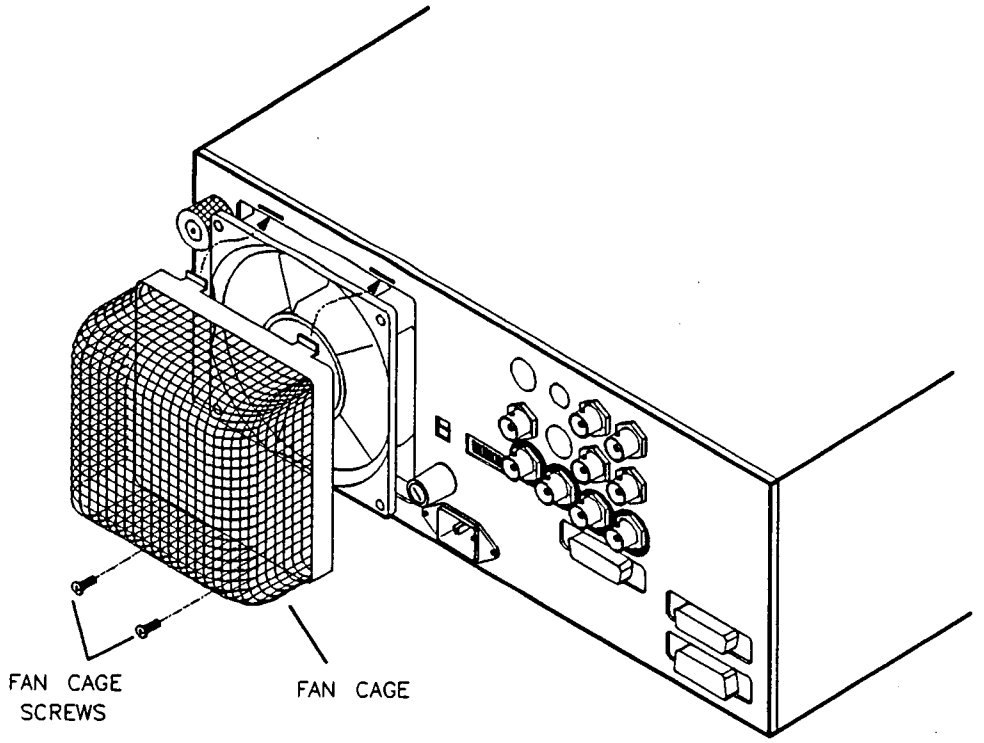


Figure 7-8. Fan Cage

Refer to Figure 7-9.

3. Remove the four fan screws.
4. Slide the fan out.
5. Remove the two-wire fan harness.

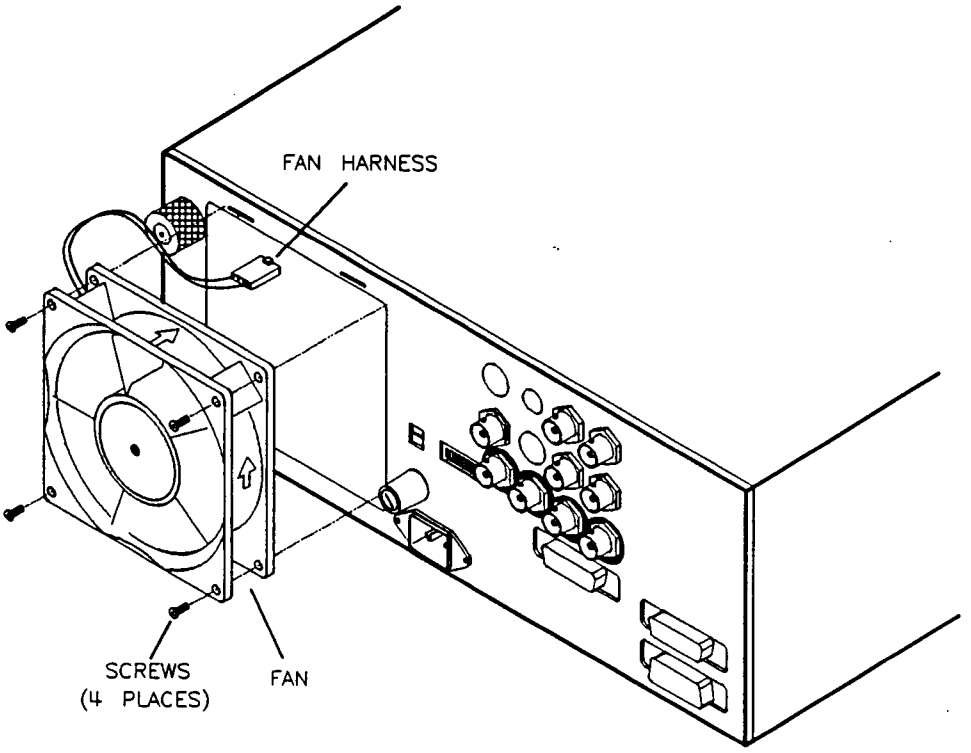


Figure 7-9. Fan Removal

3. J6, J7, and J10 Rear Panel BNC Connectors Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-10.

1. Remove the nuts and washers on the four BNC connectors, 10 MHz REF INPUT, 10 MHz REF OUTPUT, VOLTS/GHz, and TRIGGER OUTPUT.
2. Slide out the four connectors.

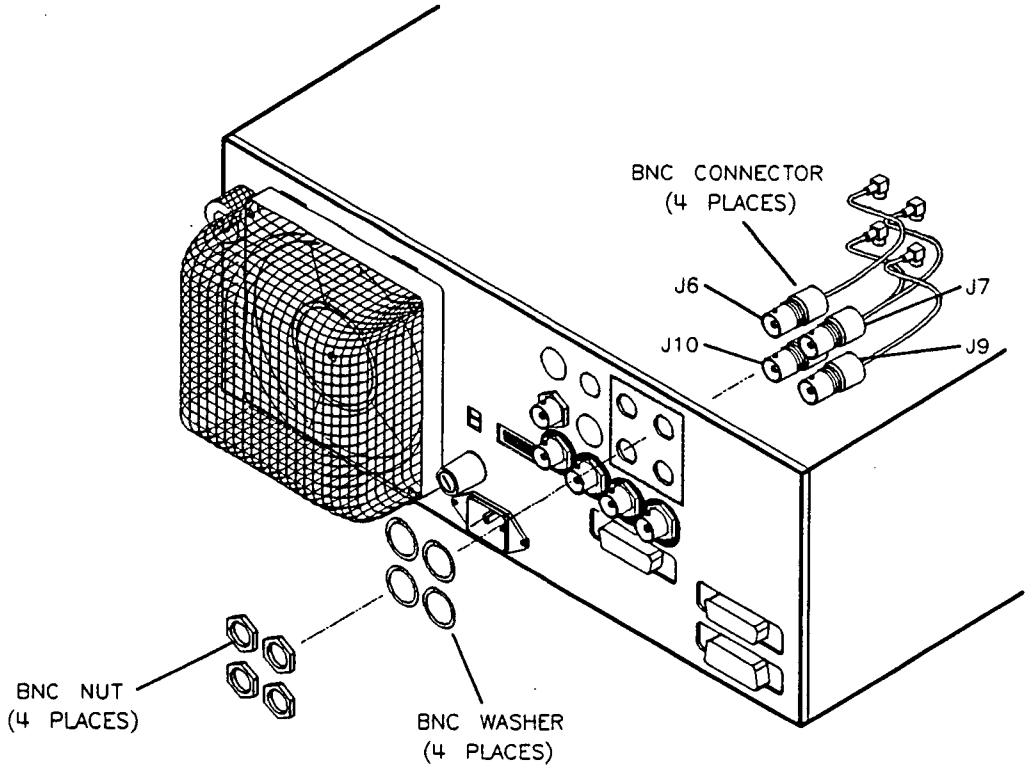


Figure 7-10. J6, J7, J9, and J10 Rear Panel BNC Connector Locations

4. J1 RF Output Connector Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-11.

Caution To avoid damaging the connector, do not disassemble the RF output connector assembly. Only unscrew the connector on the end of the semi-rigid cable.

1. Disconnect cable W43 at microwave directional coupler A30.
2. Remove the two screws from the RF output connector plate on the rear panel.
3. Remove the RF connector with cable W43 attached.

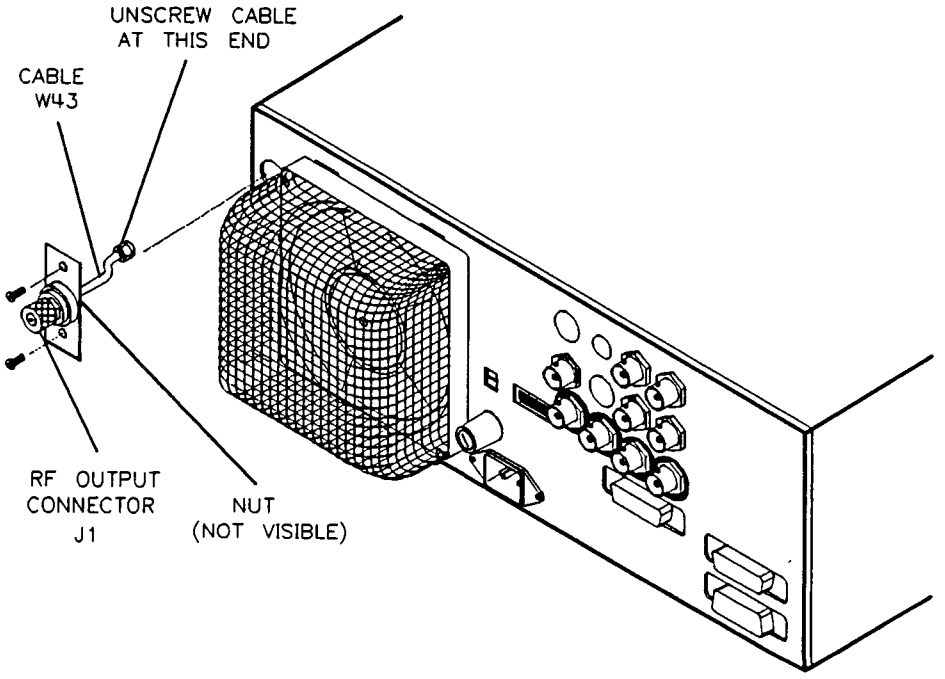


Figure 7-11. Removing RF Output Connector

Note: When you re-attach the connector and cable to the synthesizer, first, loosen the nut between cable W43 and the connector. Then perform the disassembly steps in reverse order. Finally, torque the nut between cable W43 and the connector J1 to 10 in-lb (112 N-cm).

5. Rear Panel Removal

Note: Complete "Preliminary Steps" and "J1 RF Output Connector Removal" before continuing.

Refer to Figure 7-12.

1. Remove the four screws on the top back edge.
2. Remove the four screws on the bottom back edge.
3. Slide the rear panel out of the casting.

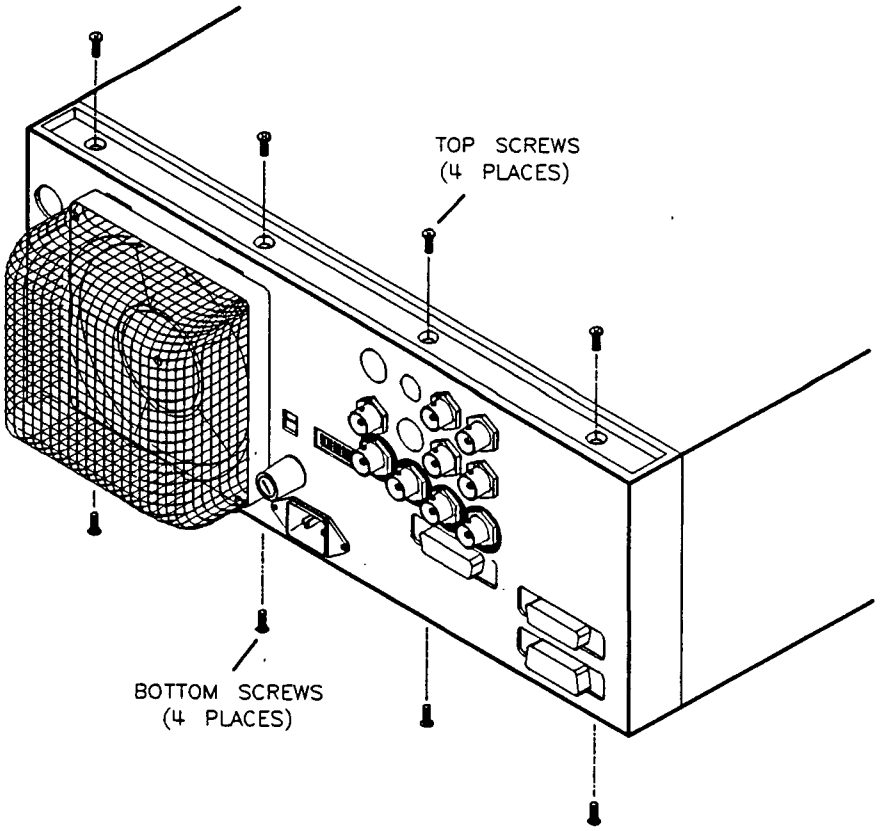


Figure 7-12. Rear Panel Removal

Refer to Figure 7-13.

4. Disconnect ribbon cable W31 from the motherboard.
5. Disconnect the 8-pin line switch connector.
6. Disconnect the fan harness.
7. Cut the tie wraps holding the coaxial cables to the four BNC connectors and the source module interface.
8. Disconnect the coaxial cables from the A7, A10, A12, and A14 assemblies and disconnect the source module interface cable from the A19 assembly.

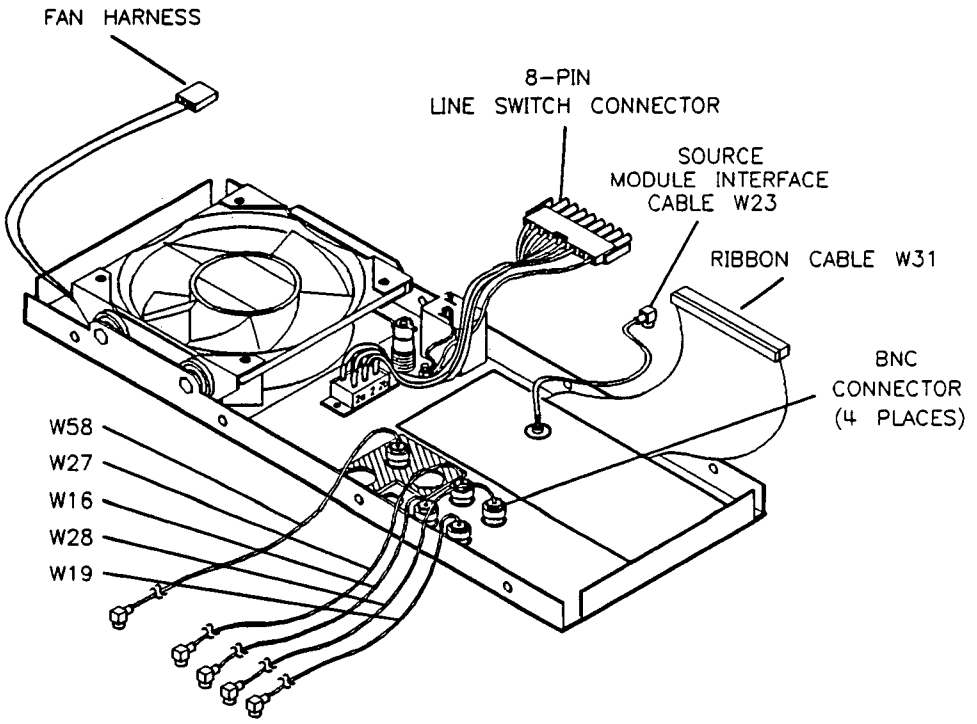


Figure 7-13. Rear Panel Cable Locations

6. A23 10 MHz Reference Standard Removal

Note: Complete "Preliminary Steps", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-14.

1. Disconnect cable W17 and the pin-locking tab, W30.
2. Without removing the screws, press the shock-mount pads through the sheet metal holes.
3. Slide the reference standard out.

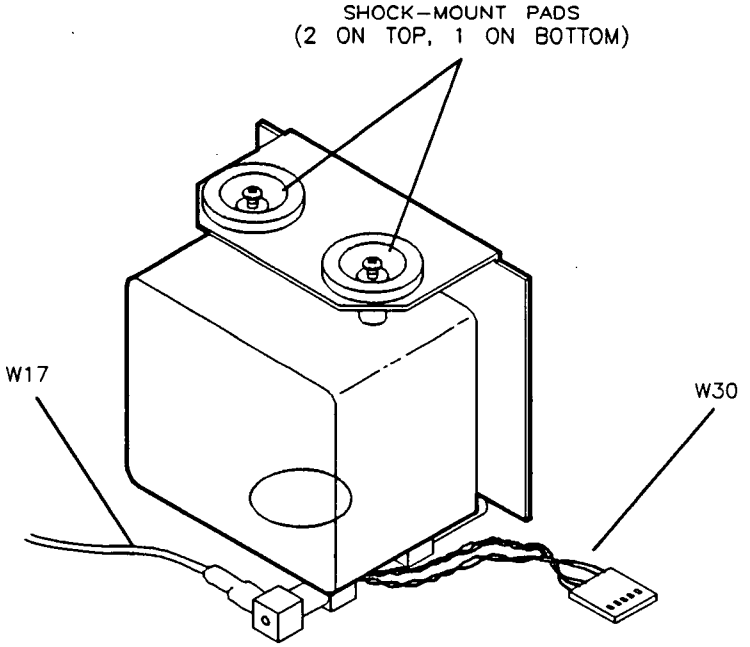


Figure 7-14. Reference Standard Mountings

7. T1 Transformer Removal

Note: Complete "Preliminary Steps", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-15.

1. Remove the six-wire pin-locking tab.
2. Remove the center screw, plastic washer, two insulators, and plate.
3. Remove the toroidal transformer.

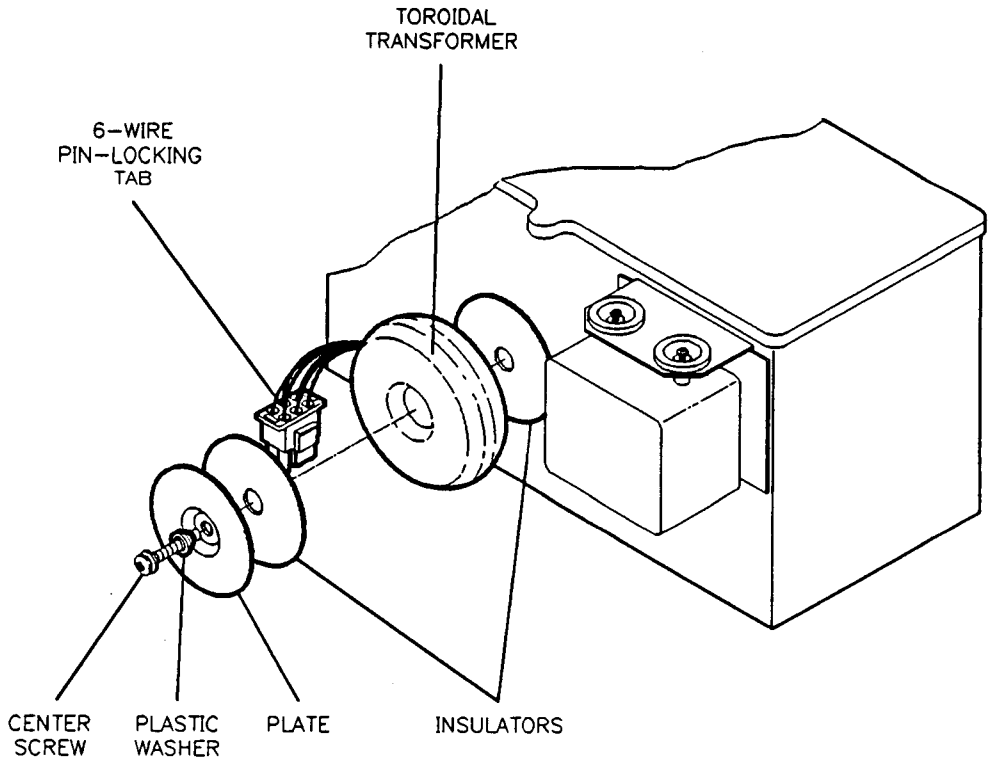


Figure 7-15. Transformer Removal

8. A19 Rear Panel Interface Removal

Note: Complete "Preliminary Steps", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-16.

1. Disconnect the source module interface cable W23 from SMB connector A10J3 on the A10 ALC assembly.
2. Remove the five screws.
3. Remove A19 from the rear panel.

Note: The source module interface cable, W23, is not included with replacement A19 assemblies.

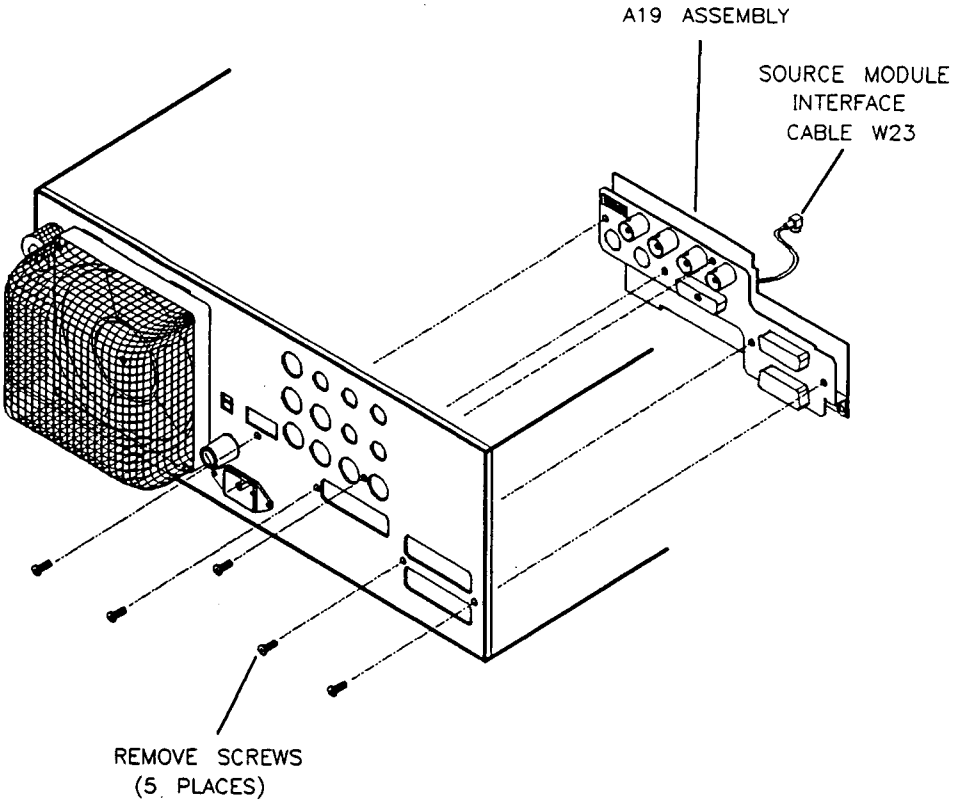


Figure 7-16. A19 Rear Panel Interface Removal

9. Voltage Selector Switch Removal

Note: Complete "Preliminary Steps", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-17.

1. Cut the tie wraps holding the wires.
2. Disconnect the 8-pin connector from the motherboard.
3. Remove the two nuts, bolts, and washers holding in the voltage selector switch.

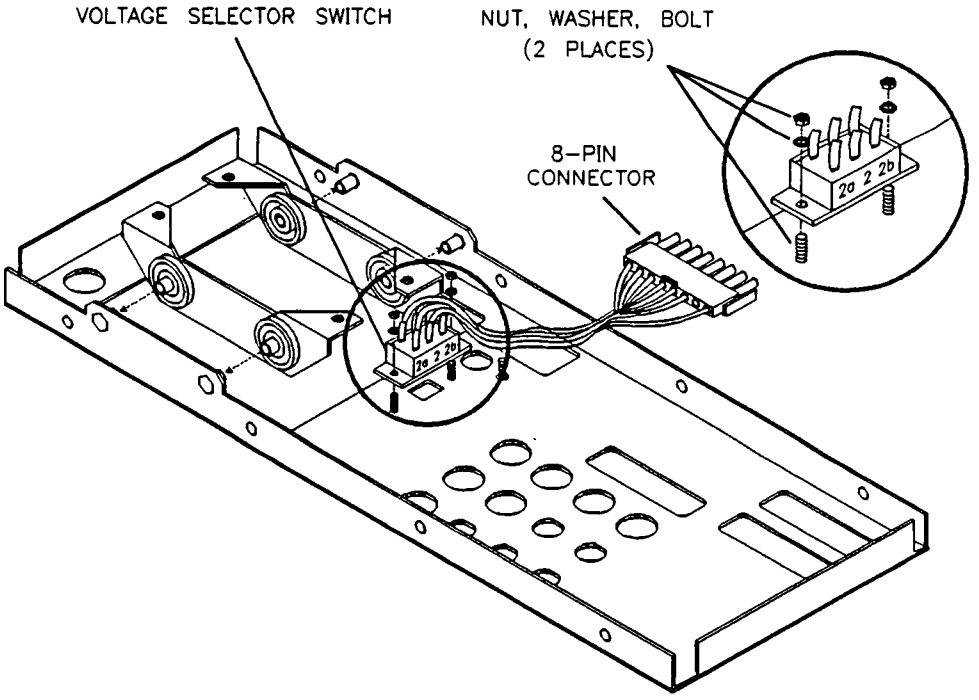


Figure 7-17. Voltage Selection Switch Removal

Refer to Figure 7-18.

4. Unsolder the white/brown/grey wire from the fuse.
5. Unsolder the white/grey wire from the line filter.
6. Unscrew the green/white ground wire from the back panel.

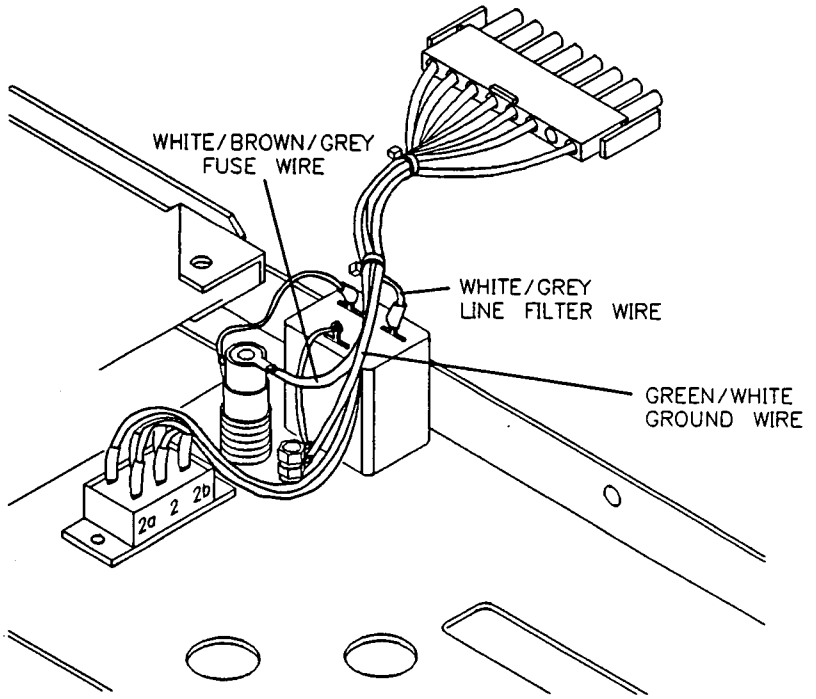


Figure 7-18. Fuse, Line Filter, and Ground Wires

Note: To reassemble, add 3/8 in. shrink tubing to each wire before soldering. Then perform the above steps in reverse order.

10. Fuse Housing Removal

Note: Complete "Preliminary Steps", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-19.

1. Remove the two nuts, bolts, and washers holding the voltage selector switch, and remove the switch (this provides clearance for the wrench to remove the fuse holder).
2. Unsolder the two fuse holder wires.
3. Unscrew the nut holding the fuse housing.
4. Slide the fuse housing out of the back panel.

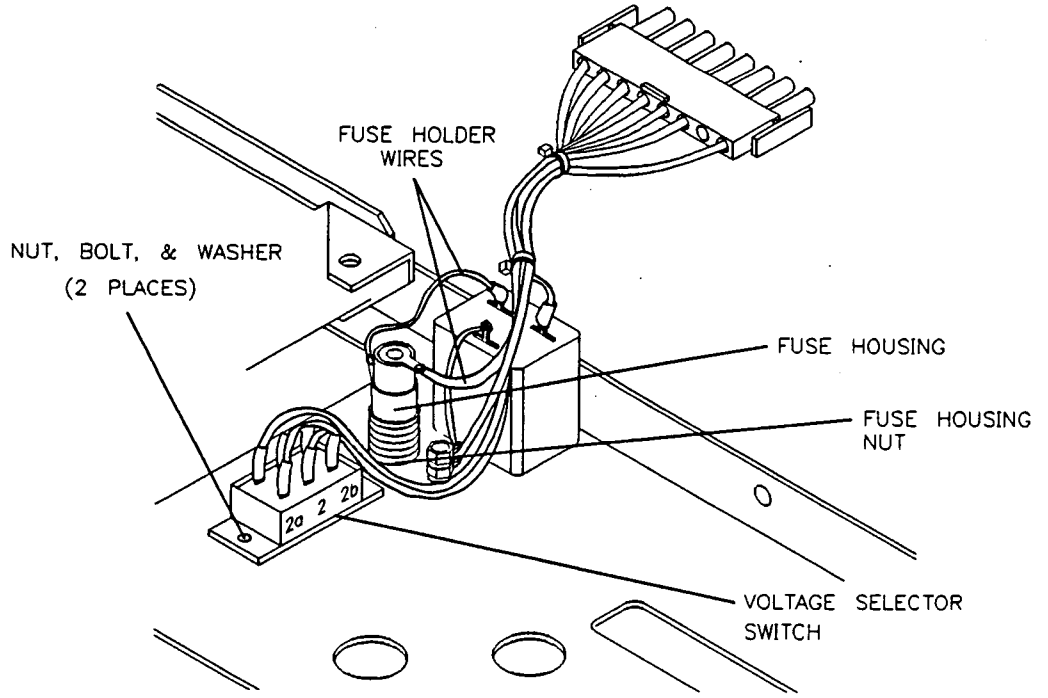


Figure 7-19. Rear Panel Fuse Housing

Note: To reassemble, add 3/8 in. shrink tubing to each wire before soldering. Then perform the above steps in reverse order.

11. FL1 Line Filter Removal

Note: Complete "Preliminary Steps", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-20.

1. Unsolder the three wires attached to the line filter.
2. Remove the two screws on the rear panel.
3. Slide out the line filter from the rear panel.

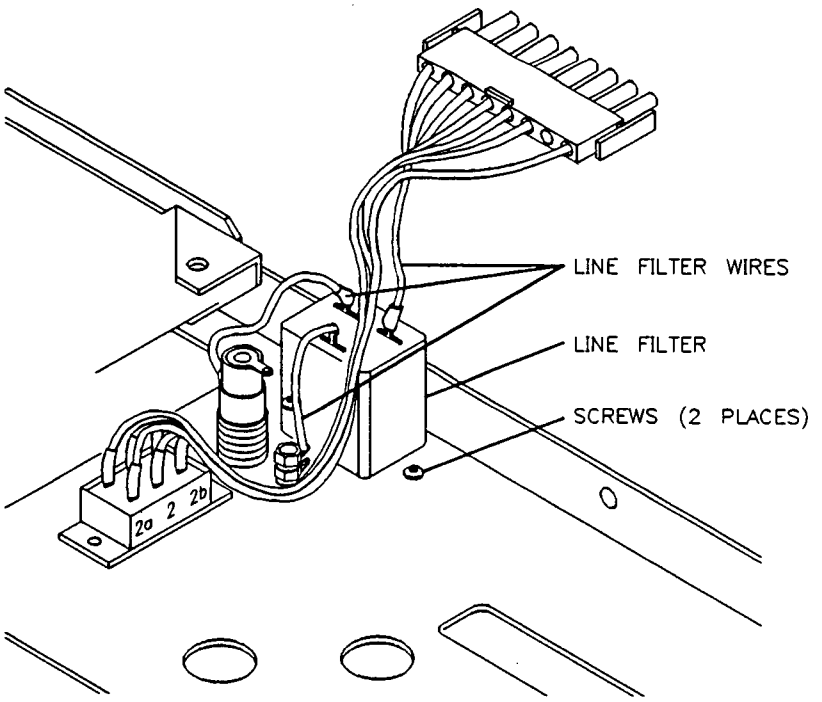


Figure 7-20. Line Filter Removal

Note: To reassemble, add 3/8 in. shrink tubing to each wire before soldering. Then perform the above steps in reverse order.

12. Ext ALC Input Rear Panel BNC Connector Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-21.

1. Disconnect cable W58 from SMB connector A10J4 on the A10 ALC assembly.
2. Remove the five screws holding the A34 RP floating BNC board assembly to the rear panel.
3. Slide out the board with the connector.

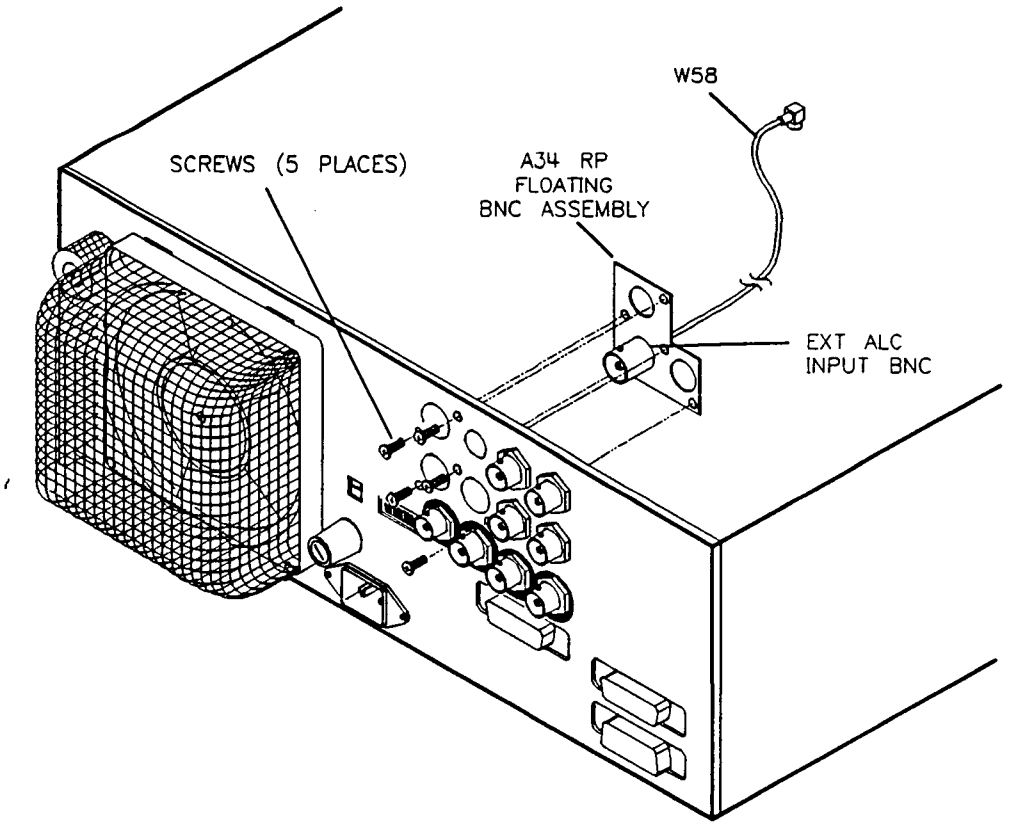


Figure 7-21. Ext ALC Input BNC Connector Removal

RF Deck Disassembly and Reassembly

Tools Required

#1 x 3 1/8 in. Pozidriv Screwdriver
T-10 Torx Screwdriver
5/16 in. Torque Wrench
5 mm Ball and Socket Driver

Note: On the RF deck, all Pozidriv screws have English threads and all Torx screws have metric threads.

Description and Procedure

To disassemble the RF deck and associated assemblies, follow this procedure in the order given.

To reassemble the RF deck and associated assemblies, follow this procedure in the reverse order.

Refer to the flowchart in Figure 7-22 to determine the necessary disassembly steps for a given assembly.

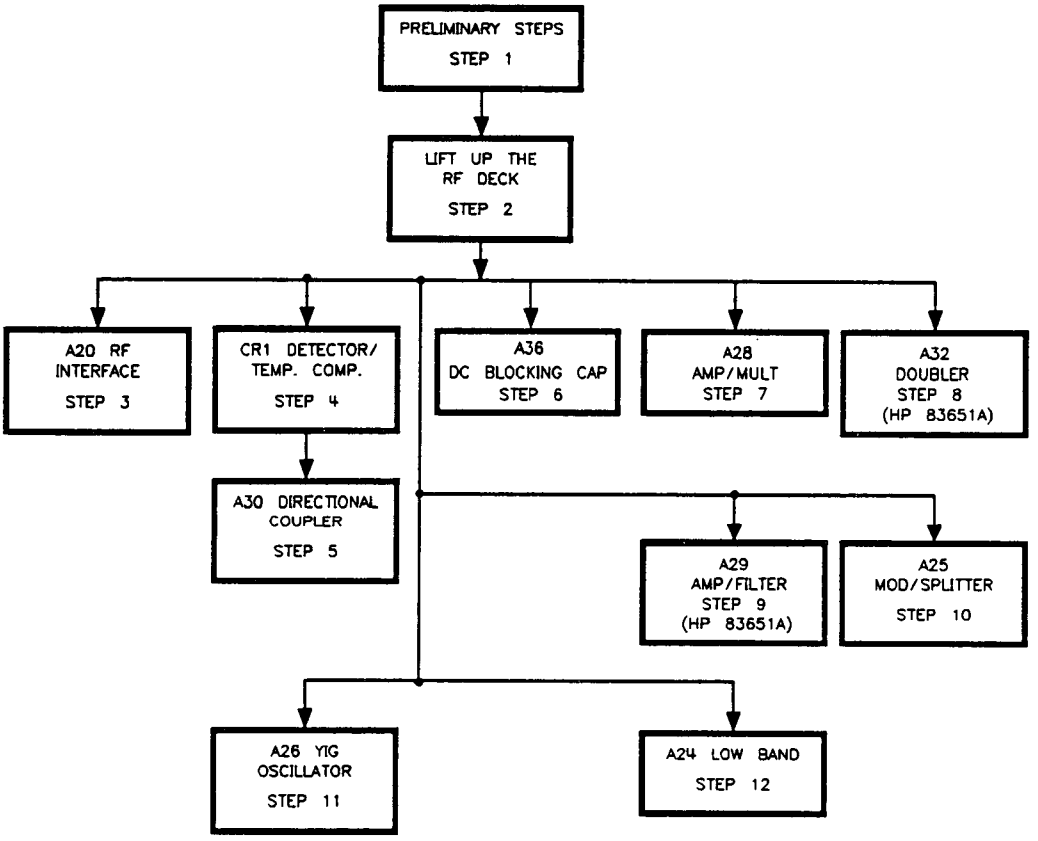


Figure 7-22. RF Deck Disassembly Flowchart

1. Preliminary Steps

Caution You can easily blow the fuse for the 13.5V supply on the preregulator assembly if you do not disconnect the AC power cord. Also, the danger of shock is increased if the power cord is connected.

1. Disconnect the AC power line cord.
2. Remove the screw from each of the top two feet on the rear panel.
3. Remove the top two feet.
4. Remove the instrument top cover.

Note: An RF braid is in each of the side channels on the top of the instrument. When you reassemble the instrument, be sure this braid remains in the channel.

2. Lift Up the Rf Deck

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-23.

Caution To avoid damaging the connector, do not disassemble the RF output connector assembly. Only unscrew the connector on the end of the semi-rigid cable.

1. Disconnect cable W43 at microwave directional coupler A30.
2. Remove the two screws from the RF output connector plate on the rear panel.
3. Remove the RF connector with cable W43 attached.

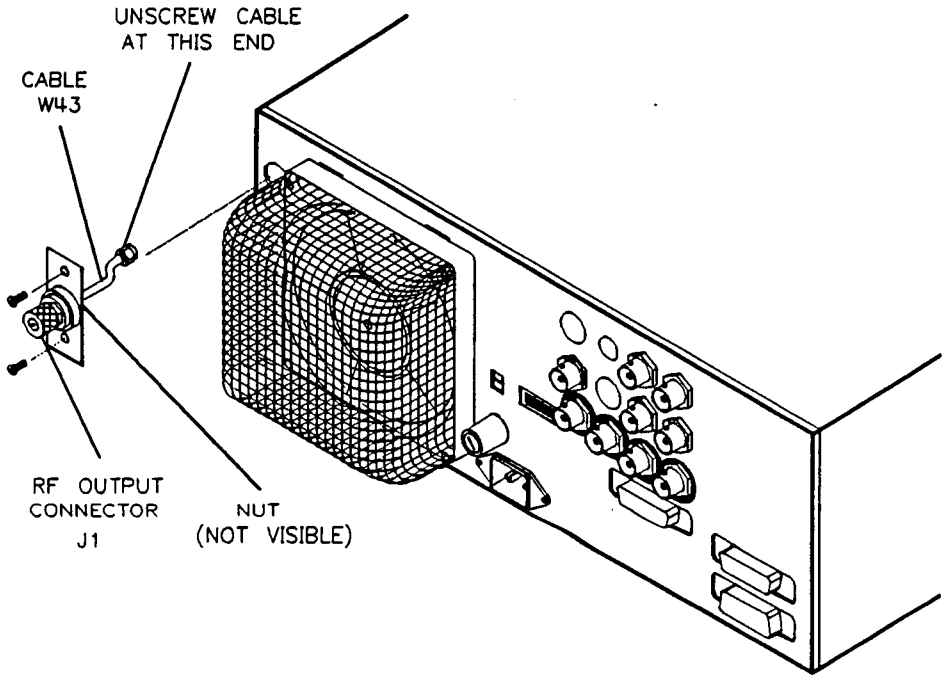


Figure 7-23. Removing RF Output Connector

Note: When you re-attach the connector and cable to the synthesizer, first loosen the nut between cable W43 and the connector. Then reverse steps 1 through 3. Finally, torque the nut between cable W43 and connector J1 to 10 in-lb (112 N-cm).

Refer to Figure 7-24.

4. Disconnect cable W51 from low pass filter FL2.
5. Remove the two hex screws from the RF deck.

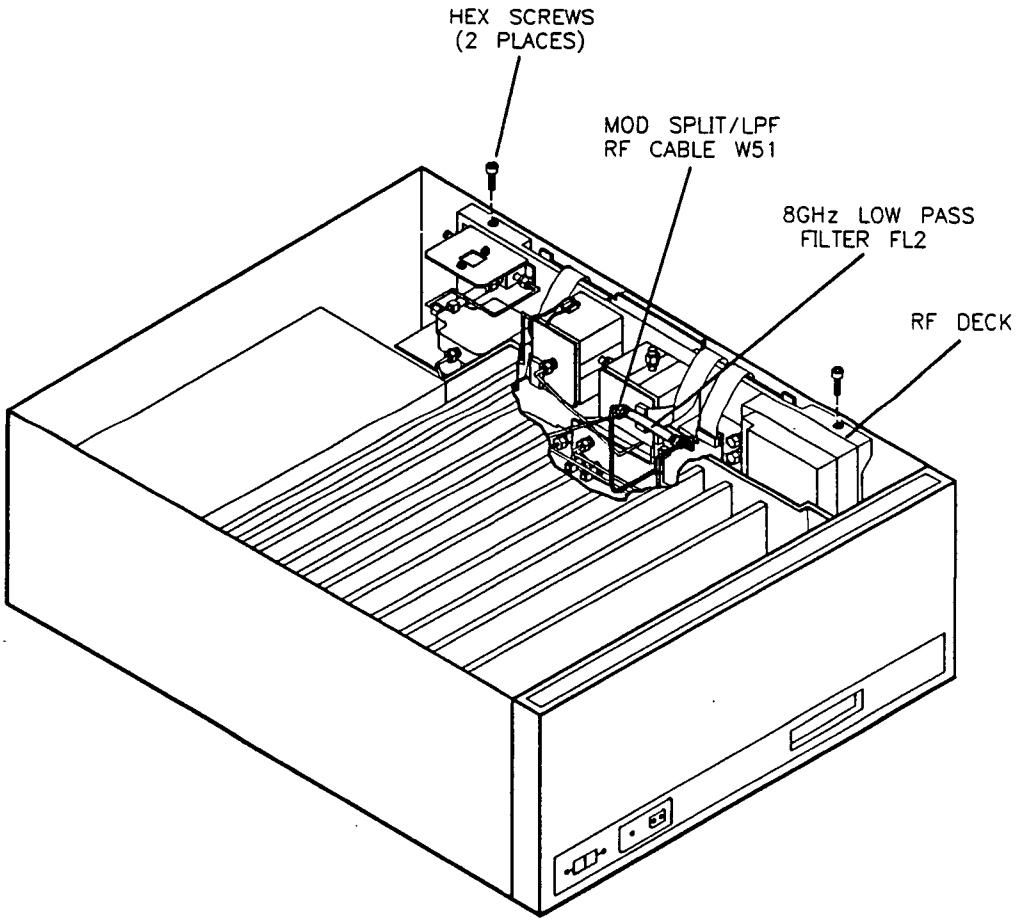


Figure 7-24. W51 RF Cable Location

Caution



Avoid damage to the various ribbon cables and their connectors attached to the RF deck assembly when removing that assembly in the next step. Move all flexible coaxial cables out of the way of the RF deck assembly components such as semi-rigid cable W51.

6. Carefully pull out the RF deck and rest it on the side of the instrument.

Note: Some flexible cables will still be attached preventing the RF deck from being completely removed from the instrument.

Refer to Figure 7-25.

Note: The analog extender board and coax extender cable mentioned in the following steps are part of the service tool kit. Refer to "Replaceable Parts" for the part number of this kit.

7. Insert an analog extender board into the motherboard connector for the RF deck (for troubleshooting). Place the RF deck on the extender board and use the two hex screws to attach the deck to the synthesizer frame (service position).
8. Attach a coax extender cable between W51 and low pass filter FL2 (for troubleshooting).
9. Reconnect the RF connector and W43 (for troubleshooting). First loosen the nut between cable W43 and the connector. Reconnect cable W43 at directional coupler A30. Then torque the nut between cable W43 and connector J1 to 10 in-lb (112 N-cm).

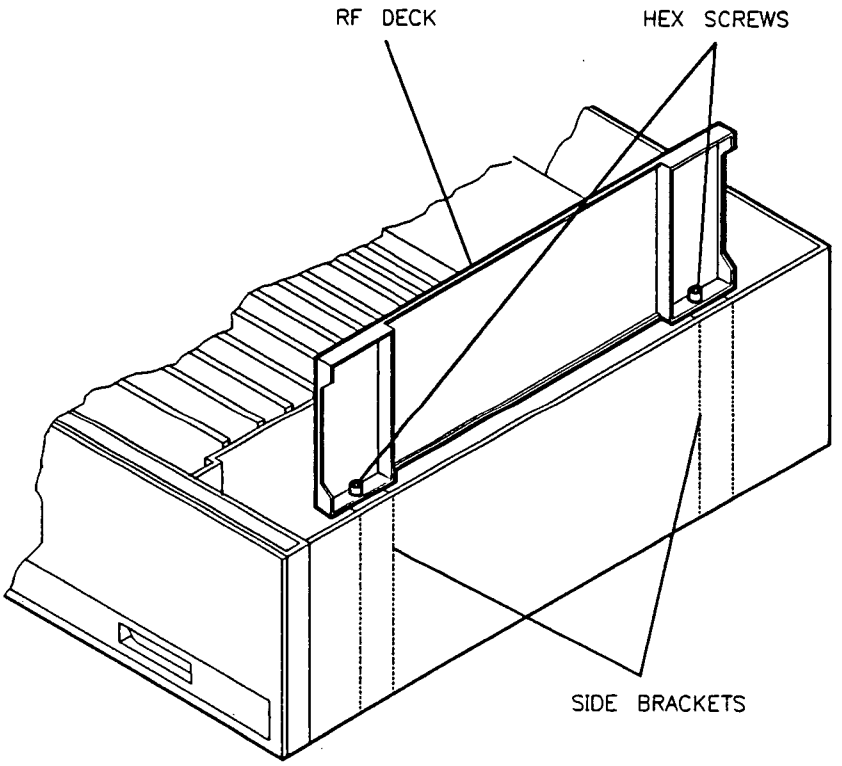


Figure 7-25. RF Deck in the Service Position

3. A20 RF Interface Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

Refer to Figure 7-26.

1. Disconnect ribbon cables W36, W37, W38, W39, W41, and W42. (You may need to loosen the two hex screws attaching the deck to the synthesizer frame in order to remove W38.)
2. Remove the 3-wire pin-locking tab.
3. Remove the four corner screws that attach the board to the casting.
4. Remove the A20 RF interface assembly.

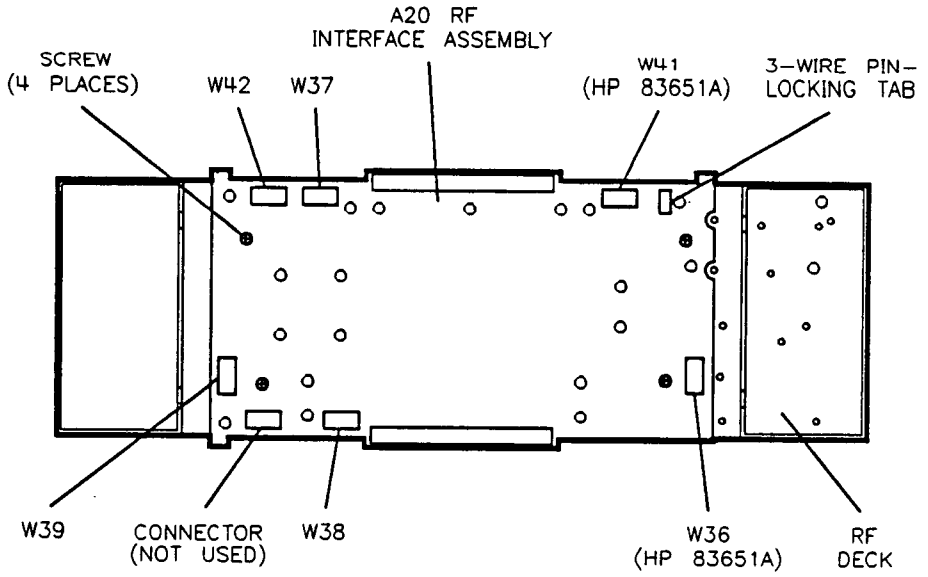


Figure 7-26. A20 RF Interface Removal

Note: For the following procedures, refer to Figure 7-27 and Figure 7-28 for cable locations and Figure 7-29 for screw locations.

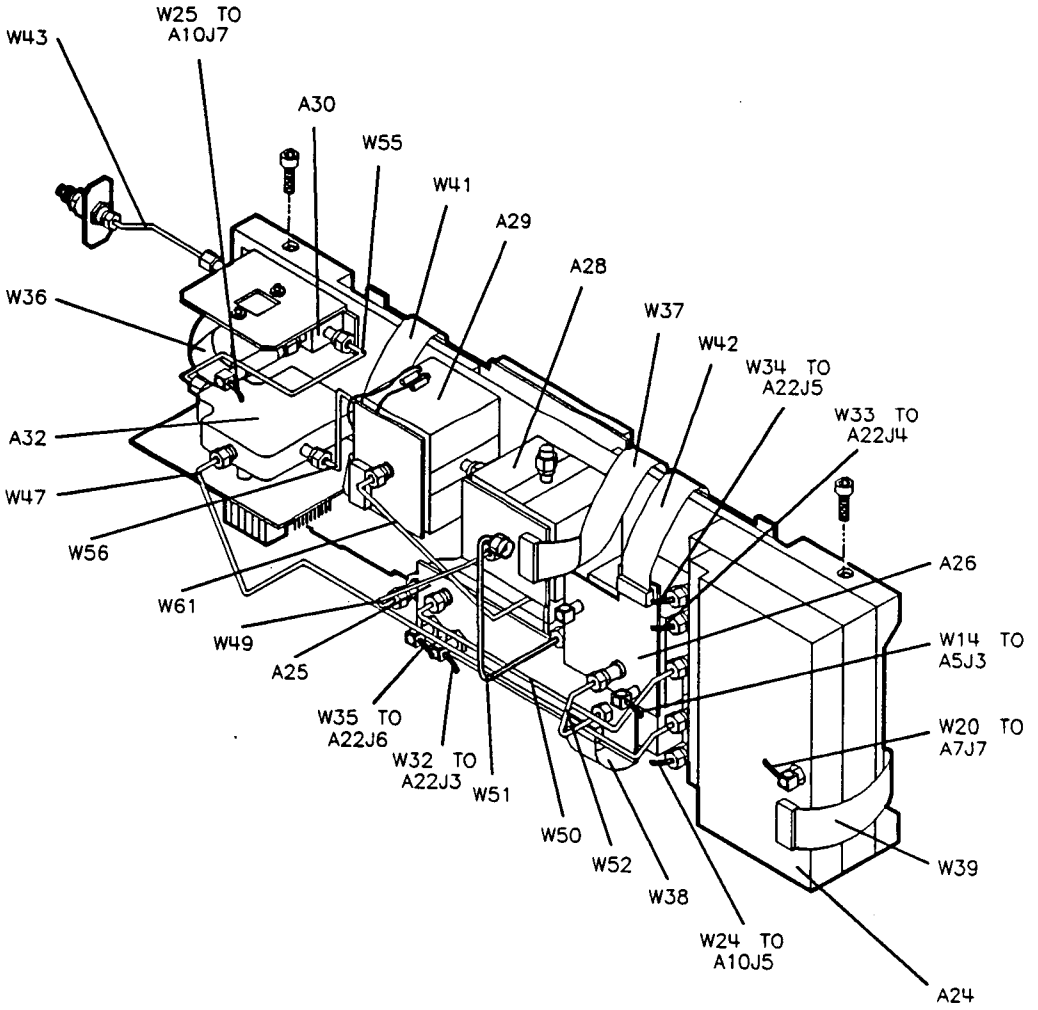


Figure 7-27. RF Deck Cable Locations - HP 83651A

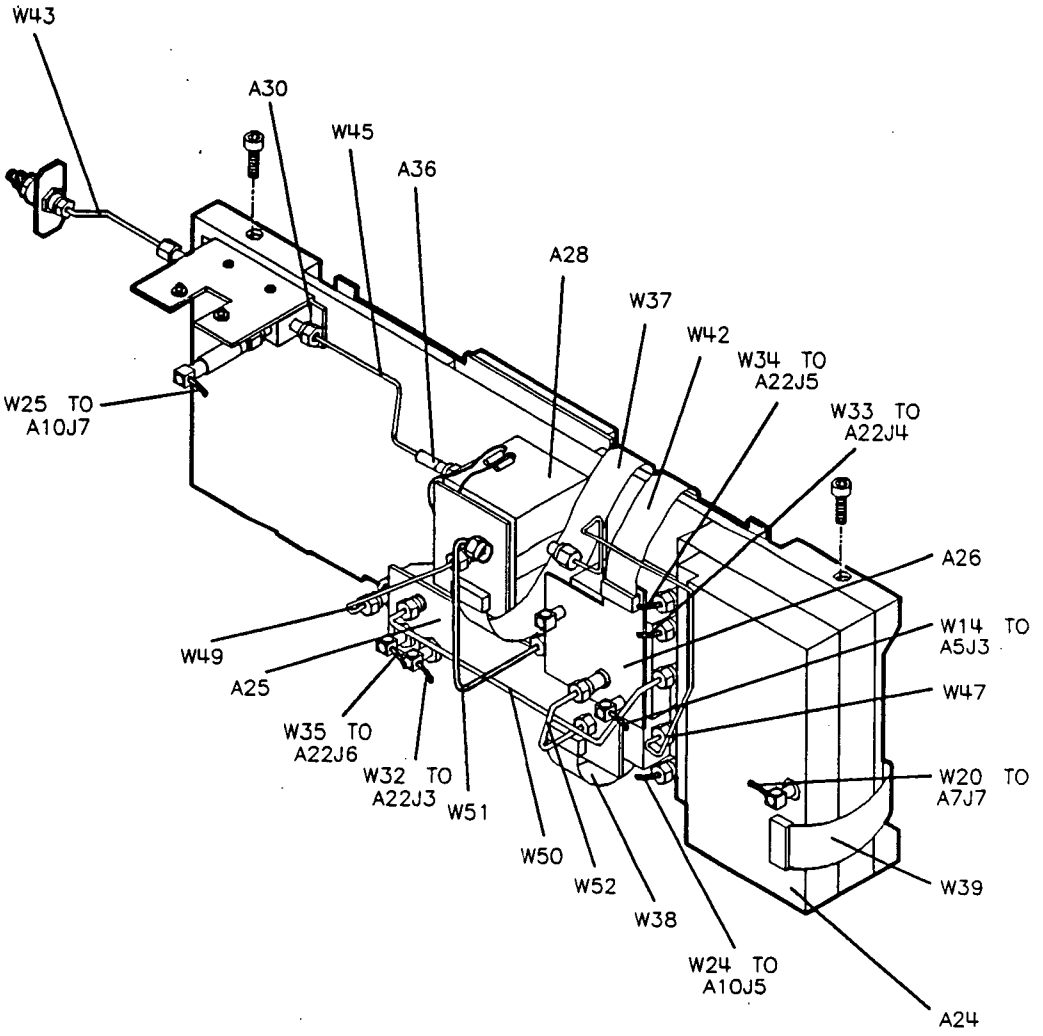
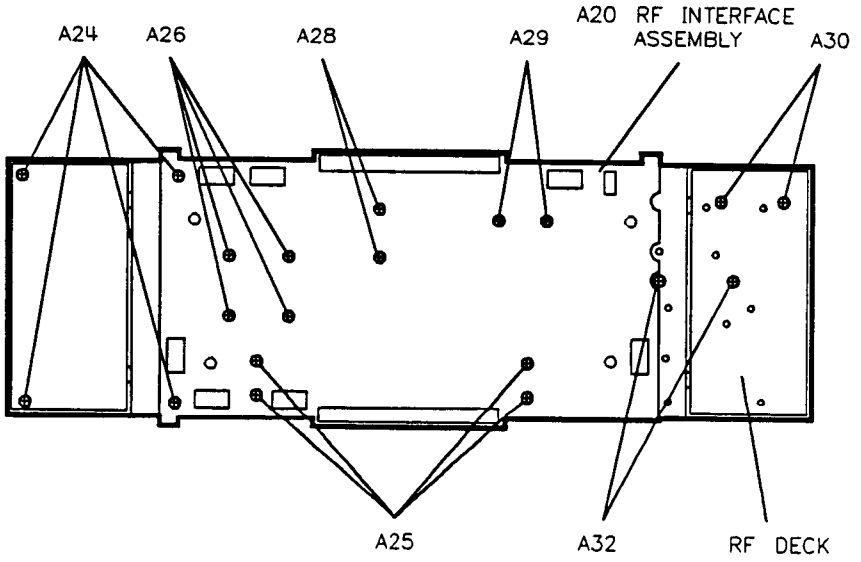
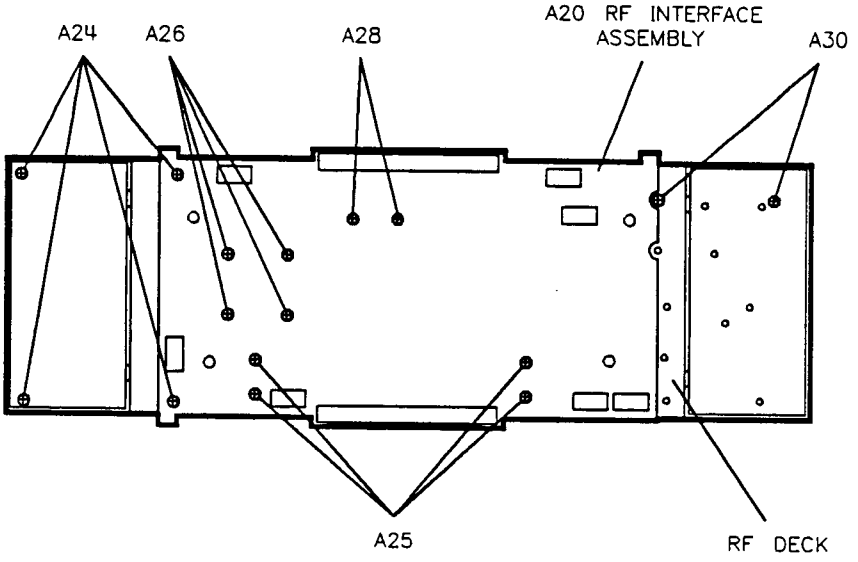


Figure 7-28. RF Deck Cable Locations - HP 83621A/31A



HP 83651A



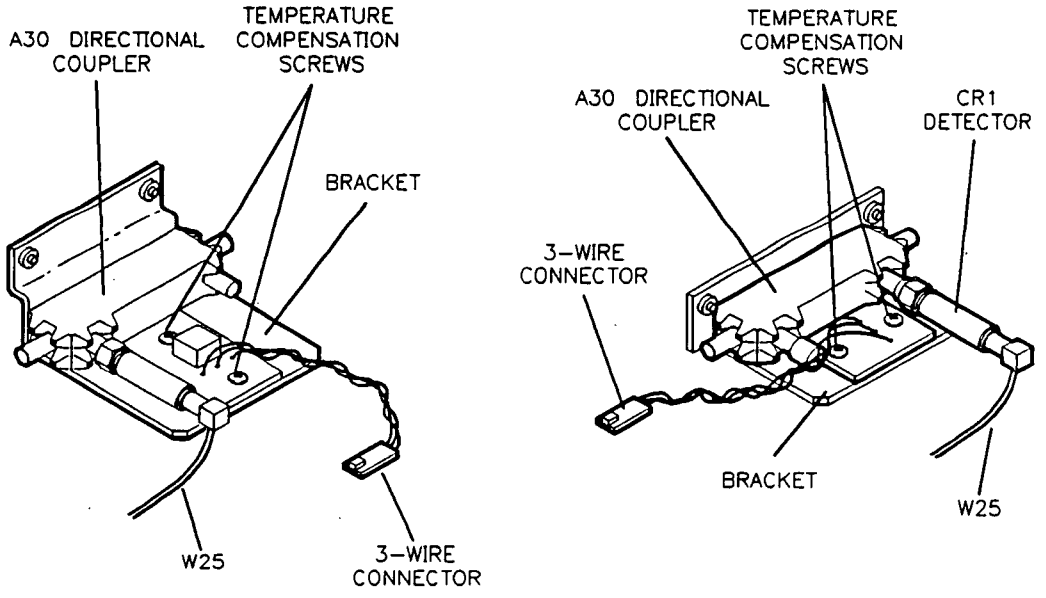
HP 83621A/31A

Figure 7-29. RF Deck Screw Locations

4. CR1 High Band Detector/Temperature Compensation Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove cable W25 (Figure 7-27 and Figure 7-28).
2. Remove detector CR1 from directional coupler A30 (Figure 7-30).



HP 83651A HP 83621A/31A

Figure 7-30. CR1 Detector/Temperature Compensation Assembly

3. Disconnect the 3-wire pin-locking tab from RF interface assembly A20.
4. Refer to Figure 7-27 and Figure 7-28. Loosen semi-rigid cable W55 at its connection to directional coupler A30.
5. Remove the two screws holding the coupler mounting bracket to the RF deck (Figure 7-29).
6. Remove the two screws that attach the temperature compensation assembly to the bracket (Figure 7-30).

5. A30 Directional Coupler Removal

Note: Complete "Preliminary Steps", "Lift Up the RF Deck", and "CR1 High Band Detector/Temperature Compensation Removal" before continuing.

1. Remove the two screws holding directional coupler A30 to the bracket (Figure 7-31).

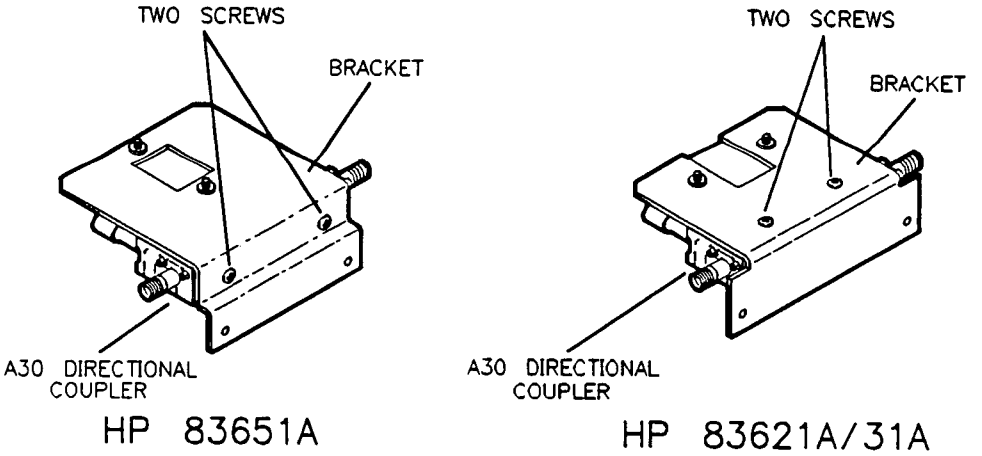


Figure 7-31. A30 Directional Coupler Bracket

6. A36 DC Blocking Capacitor Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove cable W45 (Figure 7-28).
2. Unscrew the DC blocking capacitor from the switched amplifier/multiplier, A28.

6. A28 Amplifier/Multiplier Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove ribbon cable W37, and cables W49 and W61 (Figure 7-27 and Figure 7-28).
2. Remove the two screws holding A28 to the RF deck (Figure 7-29).

7. A29 Amplifier/Filter Removal (HP 83651A)

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove ribbon cable W41, and cables W56 and W61 (Figure 7-27).
2. Remove the two screws holding A29 to the RF deck (Figure 7-29).

8. A32 Doubler Removal (HP 83651A)

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove ribbon cable W36 and cables W47 and W55.
2. Loosen the two screws holding the doubler to the RF deck and remove cable W56.
3. Remove the two screws holding the doubler to the RF deck.

9. A25 Modulator/Splitter Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove ribbon cable W38, and cables W32, W35, W49, W50, W51, and W52 (Figure 7-27 and Figure 7-28).
2. Remove the four screws holding A25 to the RF deck (Figure 7-29).

10. A26 YIG Oscillator Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove W14, W52, and ribbon cable W42 (Figure 7-27 and Figure 7-28).
2. Remove the four screws holding A26 to the RF deck (Figure 7-29).

11. A24 Low Band Removal

Note: Complete "Preliminary Steps" and "Lift Up the RF Deck" before continuing.

1. Remove W20, W24, W33, W34, W47, W50, and ribbon cable W39 (Figure 7-27 and Figure 7-28).
2. Remove the four screws holding A24 to the RF deck (Figure 7-29).

Motherboard Disassembly and Reassembly

Tools Required

T-15 Torx Screwdriver
#2 x 4 Pozidriv Screwdriver
5/16 in. Open End Wrench
5mm Ball and Scoket Driver

Description and Procedure

To disassemble the motherboard, follow this procedure in the order given.

To reassemble the motherboard, follow this procedure in the reverse order.

Caution Cable routing may affect instrument performance. Refer to Figure 7-1 for a diagram of the instrument cable routing.

Refer to the flowchart in Figure 7-32 to determine the necessary disassembly steps for a given assembly.

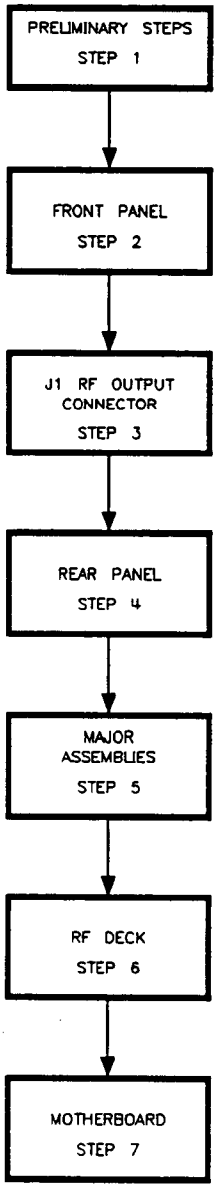


Figure 7-32. Motherboard Disassembly Flowchart

1. Preliminary Steps

Caution 

You can easily blow the fuse for the 13.5V supply on the preregulator assembly if you do not disconnect the AC power cord. Also, the danger of shock is increased if the power cord is connected.

1. Disconnect the AC power line cord.
2. Remove the screw from each of the four feet on the rear panel.
3. Remove the four rear feet.
4. Remove the four bottom feet.
5. To remove the side straps, remove the two screws on each side panel.
6. Remove the vinyl trim strip from the top, front edge of the instrument. (Place a flat screwdriver in either slot in the trim strip and lift to remove, see Figure 7-33).
7. Remove the instrument top, bottom, and side covers.

Note: An RF braid is in each of the side channels on the top and bottom of the instrument. When you reassemble the instrument, be sure the braids remain in the side cover channels.

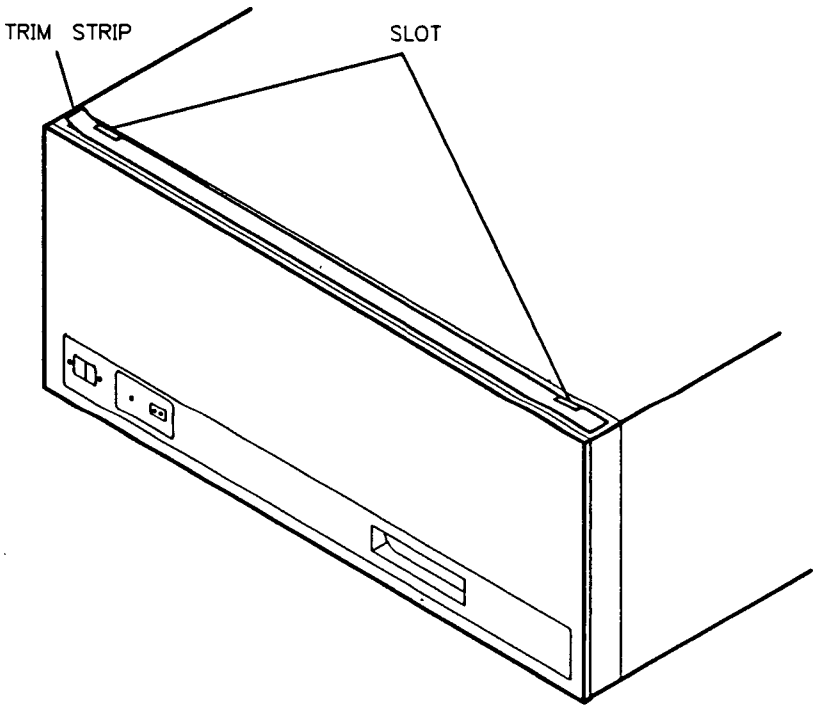


Figure 7-33. Front Edge Trim Strip

2. Front Panel Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-34.

1. Remove *three* of the four screws under the trim strip.
2. Remove *two* of the three screws on the lower, front frame edge.
3. Gently pry the front panel and display from the frame.

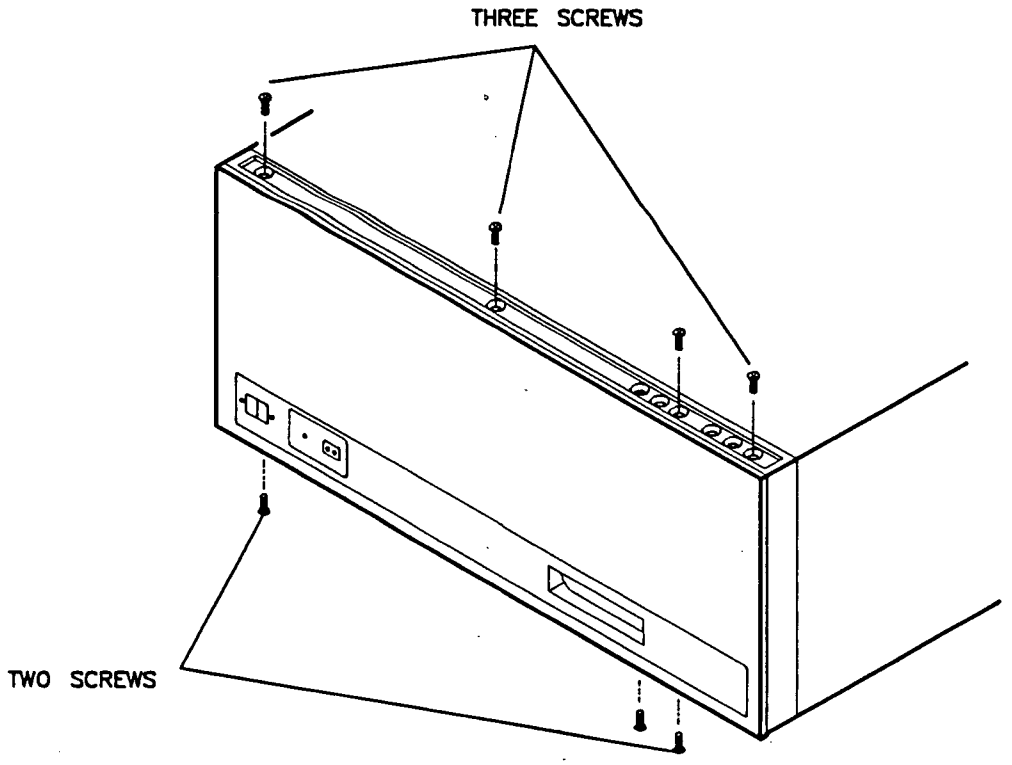


Figure 7-34. Front Panel Screw Locations

Refer to Figure 7-35.

4. Disconnect coaxial cable W10 at the A10J2 SMB connection on the A10 ALC board assembly. Disconnect ribbon cable W2 at the A22J1 connector on the A22 motherboard assembly.

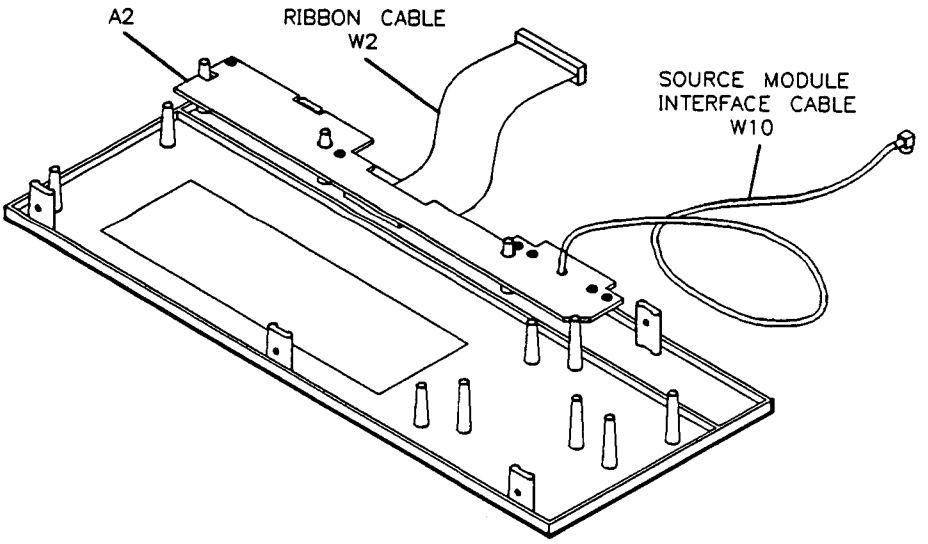


Figure 7-35. Front Panel Coaxial and Ribbon Cable Locations

3. J1 RF Output Connector Removal

Note: Complete "Preliminary Steps" before continuing.

Refer to Figure 7-36.

Caution To avoid damaging the connector, do not disassemble the RF output connector assembly. Only unscrew the connector on the end of the semi-rigid cable.

1. Disconnect cable W43 at microwave directional coupler A30.
2. Remove the two screws from the RF output connector plate on the rear panel.
3. Remove the RF connector with cable W43 attached.

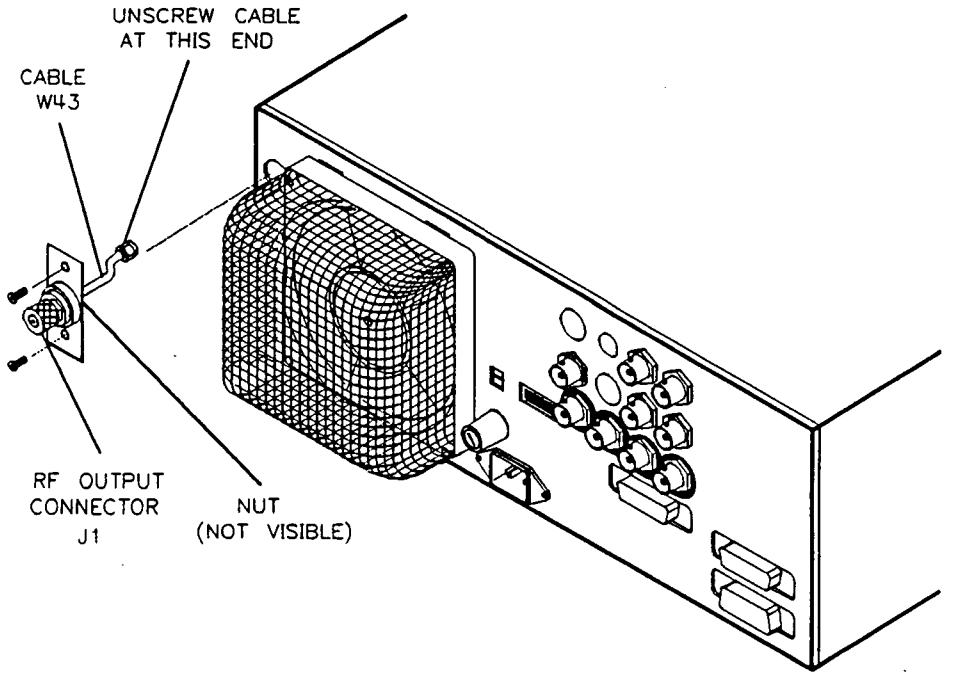


Figure 7-36. Removing RF Output Connector

Note: When you re-attach the connector and cable to the synthesizer, first, loosen the nut between cable W43 and the connector. Then reverse the steps above. Finally, torque the nut between cable W43 and the connector J1 to 10 in-lb (112 N-cm).

4. Rear Panel Removal

Note: Complete "Preliminary Steps" and "J1 RF Output Connector Removal" before continuing.

Refer to Figure 7-37.

1. Remove the four screws on the top back edge.
2. Remove the four screws on the bottom back edge.
3. Slide the rear panel out of the casting.

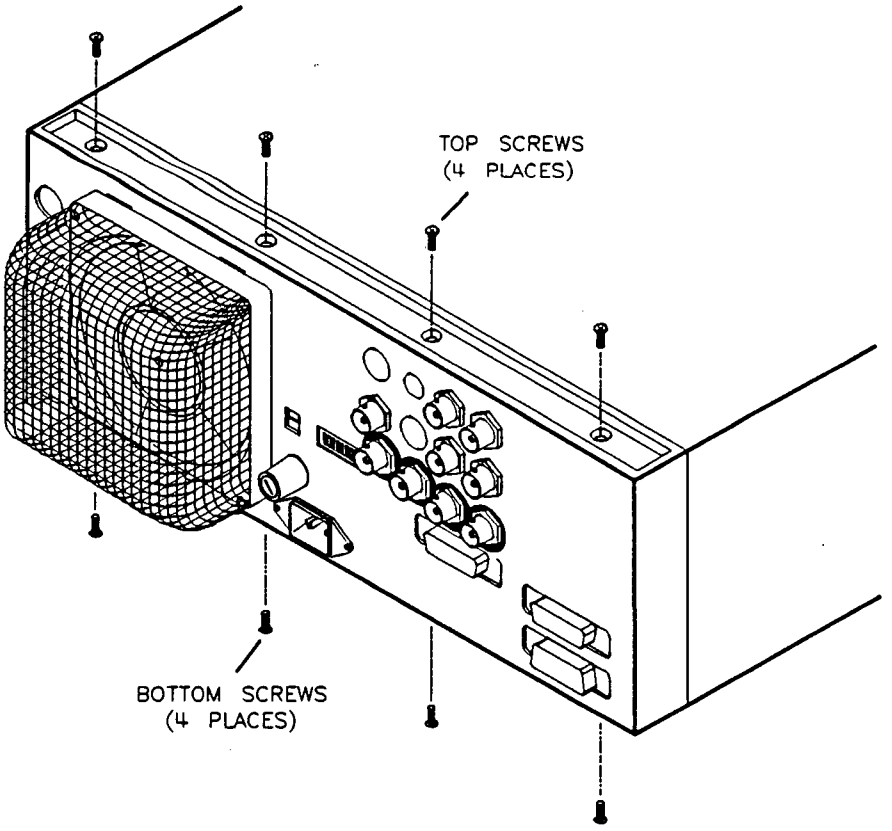


Figure 7-37. Rear Panel Removal

Refer to Figure 7-38.

4. Disconnect ribbon cable W31 from the motherboard.
5. Disconnect the 8-pin line switch connector.
6. Disconnect the fan harness.
7. Cut the tie wraps holding the coaxial cables to the four BNC connectors and the source module interface.
8. Disconnect the coaxial cables from the A7, A10, A12, and A14 assemblies and disconnect the source module interface cable from the A19 assembly.

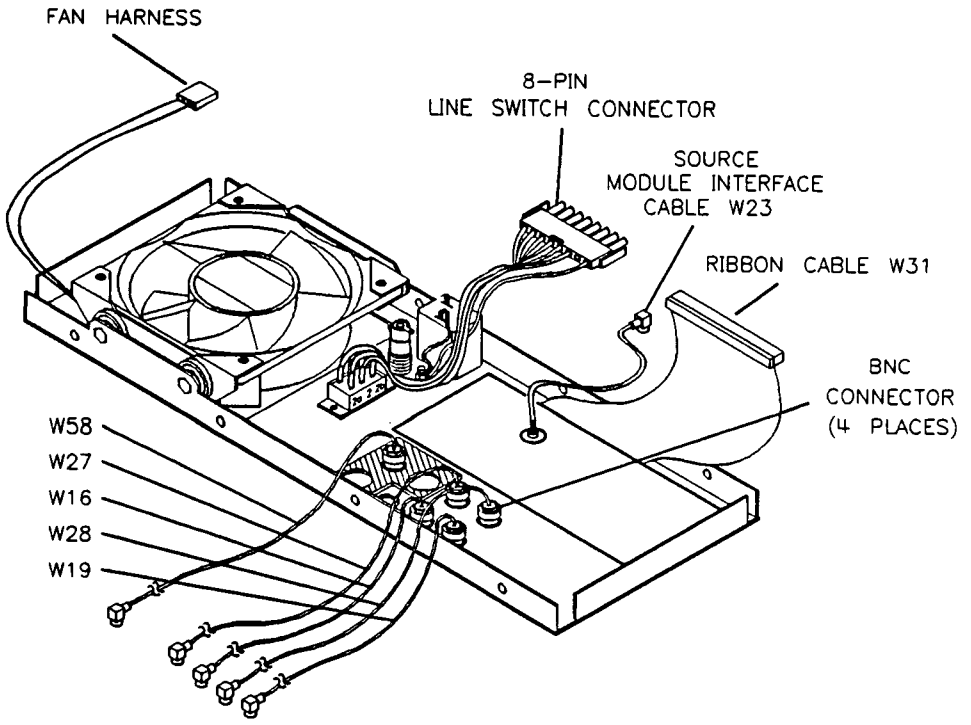


Figure 7-38. Rear Panel Cable Locations

5. Major Assemblies Removal

Note: Complete "Preliminary Steps", "Front Panel Removal", "J1 RF Output Connector Removal", and "Rear Panel Removal" before continuing.

Refer to Figure 7-39.

1. Remove the six screws from the regulator shield.
2. Remove the shield.
3. Cut the tie wraps holding the cables attached to the PC assemblies.
4. Disconnect all cables attached to the PC assemblies.
5. Disconnect semi-rigid cable W54 from the A6 assembly.

Note: All cables are labeled for easy reassembly. Refer to the "Special Cases" section of "Troubleshooting", paragraph SC.050 for a diagram of the instrument cable locations.

6. Pull out all PC assemblies.

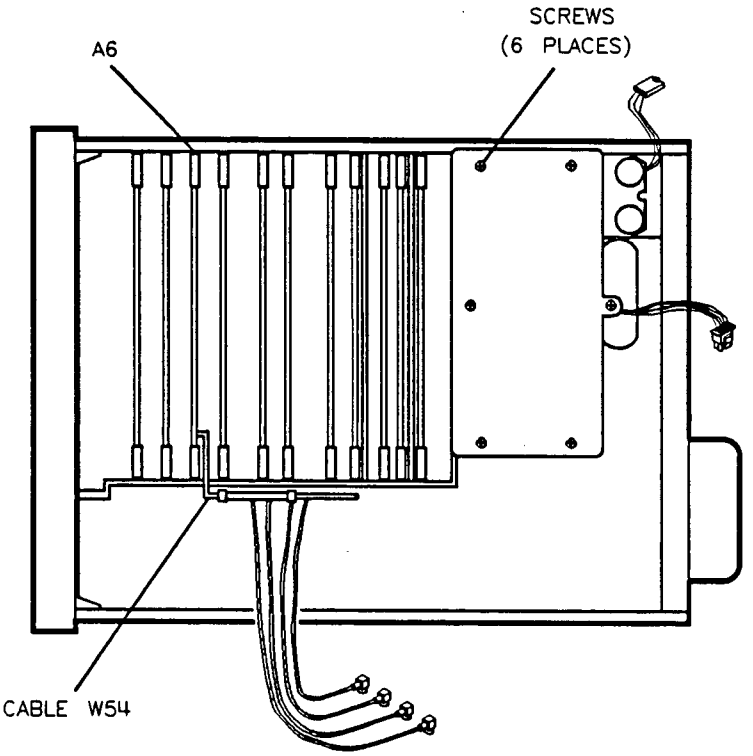


Figure 7-39. Major Assemblies

6. RF Deck Removal

Note: Complete "Preliminary Steps" and "J1 RF Output Connector Removal" before continuing.

Refer to Figure 7-40.

1. Disconnect cable W51 from low pass filter FL2.
2. Remove the two hex screws from the RF deck.

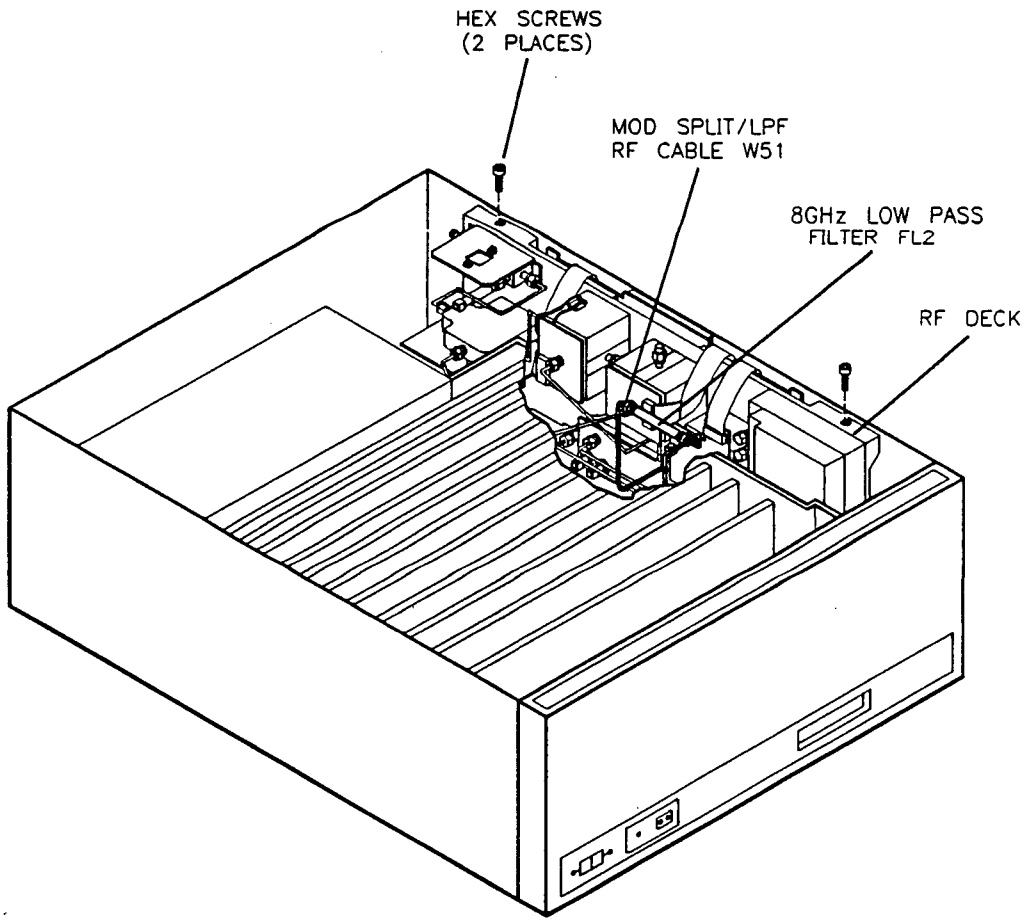


Figure 7-40. W51 RF Cable Location

Caution



Avoid damage to the various ribbon cables and their connectors attached to the RF deck assembly when removing that assembly in the next step. Move all flexible coaxial cables out of the way of the RF deck assembly components such as semi-rigid cable W51.

3. Carefully pull out the RF deck and rest it on the side of the instrument.
4. Remove flexible cables W32, W33, W34, and W35 from the motherboard.

7. Motherboard Removal

Note: Complete "Preliminary Steps", "Front Panel Removal", "J1 RF Output Connector Removal", "Rear Panel Removal", "Major Assemblies Removal", and "RF Deck Removal" before continuing.

Refer to Figure 7-41.

1. Disconnect the transformer pin-locking tab and the reference oscillator pin-locking tab.

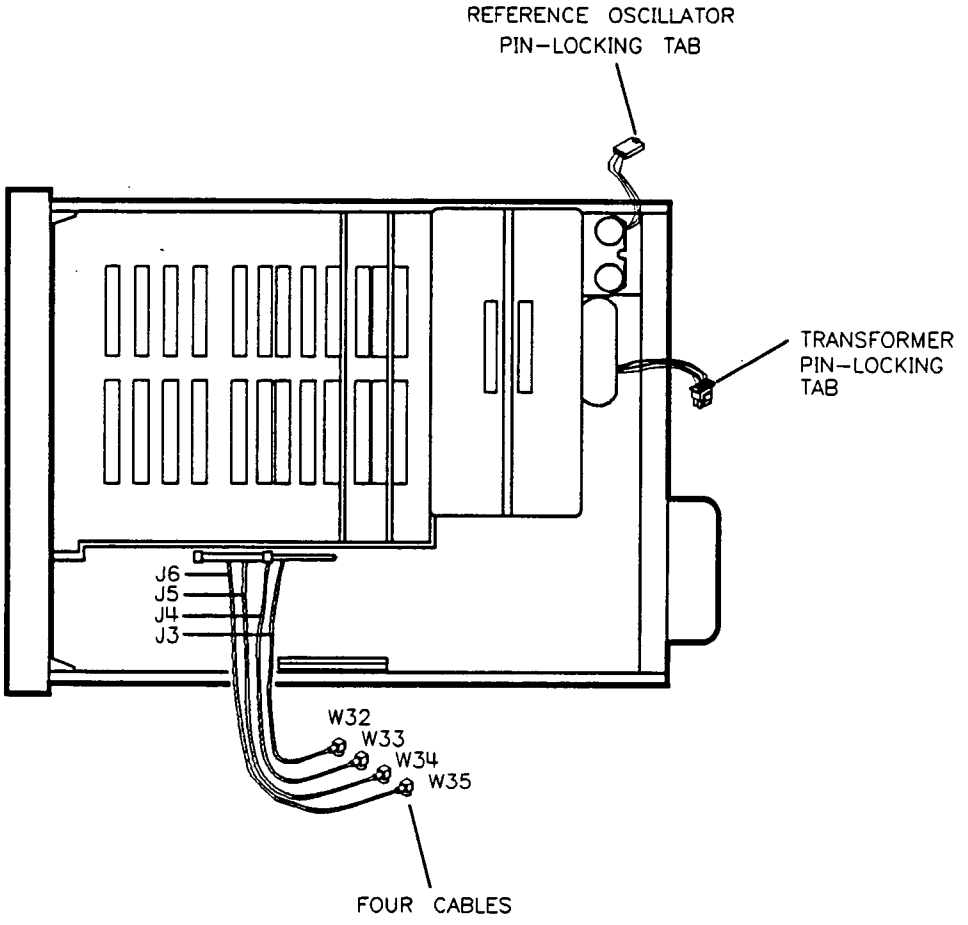


Figure 7-41. Motherboard Cables

2. Remove the 16 screws from the bottom side of the motherboard bottom side Figure 7-42.
3. Lift off the motherboard.

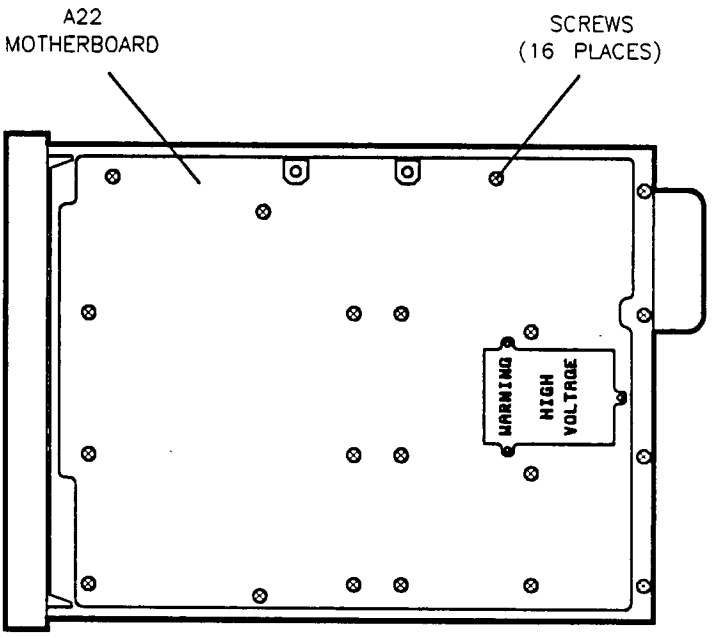


Figure 7-42. Motherboard Screws

Table 8-1.
Adjustments and Performance Tests Required After Repair or Replacement of an Assembly

Assembly	Adjustment	Performance Test
A2 Source Module Interface	None	Full Self-Test
A4 Fractional-N[1]	Fractional-N VCO Fractional-N Reference and API Spurs	Full Self-Test CW Frequency Accuracy
A5 YO Phase Detector	YO Loop Gain	Full Self-Test CW Frequency Accuracy
A6 Sampler	Sampler Assembly	Full Self-Test CW Frequency Accuracy
A7 Reference	None	Full Self-Test CW Frequency Accuracy
A9 Pulse (HP 83621A/31A)	Amp/Mult Adjustments	Full Self-Test Maximum Leveled Power
A9 Pulse (HP 83651A)	Amp/Mult Adjustments Amp/Filter Adjustments	Full Self-Test Maximum Leveled Power
A10 ALC	Modulator Offset and Gain ALC Power Level Accuracy Power Flatness	Full Self-Test Maximum Leveled Power
A12 SYTM Driver (HP 83621A/31A)	Amp/Mult Adjustments Low Power SRD Bias	Full Self-Test Maximum Leveled Power
A12 Mult/Filter Driver (HP 83651A)	Amp/Mult Adjustments Amp/Filter Adjustments Low Power SRD Bias	Full Self-Test Maximum Leveled Power
A13 YO Driver	YO Driver +10V Reference YO Driver Gain and Linearity YO Delay (automated)	Full Self-Test CW Frequency Accuracy Swept Frequency Accuracy
A14 Sweep Generator	Sweep Ramp	Full Self-Test Swept Frequency Accuracy
A15 CPU	ADC (automated)	Full Self-Test HP-IB Self-Test

1 The adjustments listed are required only after *repair* of the assembly. The *replacement* assembly is adjusted at the factory and is not instrument-dependent.

Table 8-1.
Adjustments and Performance Tests Required After Repair or Replacement of an Assembly (continued)

Assembly	Adjustment	Performance Test
A16 Postregulator	None	Full Self-Test
A17 Rectifier/Filter	None	Full Self-Test
A18 Switching Regulator	None	Full Self-Test
A19 Rear Panel Interface	None	Full Self-Test HP-IB Self-Test
A20 RF Interface	None	Full Self-Test Operation Verification
A22 Motherboard	None	Full Self-Test Operation Verification
A23 10 MHz Reference[1]	10 MHz Standard	Full Self-Test CW Frequency Accuracy
A24 Low Band	Modulator Offset and Gain ALC Power Level Accuracy Power Flatness	Full Self-Test Maximum Leveled Power
A25 Modulator/Splitter	Modulator Offset and Gain ALC Power Level Accuracy Power Flatness	Full Self-Test Maximum Leveled Power
A26 YIG Oscillator	YO Driver Gain and Linearity YO Delay (Automated)	Full Self-Test CW Frequency Accuracy Maximum Leveled Power Swept Frequency Accuracy
A27 Isolator (HP 83621A/31A)	None	Full Self-Test Maximum Leveled Power
A28 Switched Amp/Mult (HP 83621A/31A)	Amp/Mult Adjustments Low Power SRD Bias	Full Self-Test Maximum Leveled Power
A28 Amp/Mult (HP 83651A)	Amp/Mult Adjustments Amp/Filter Adjustments Low Power SRD Bias	Full Self-Test Maximum Leveled Power

1 The adjustments listed are required only after *repair* of the assembly. The *replacement* assembly is adjusted at the factory and is not instrument-dependent.

Table 8-1.
Adjustments and Performance Tests Required After Repair or Replacement of an Assembly (continued)

Assembly	Adjustment	Performance Test
A29 Amp/Filter (HP 83651A)	Amp/Mult Adjustments Amp/Filter Adjustments Low Power SRD Bias	Full Self-Test Maximum Leveled Power
A30 Directional Coupler	ALC Power Level Accuracy Power Flatness	Full Self-Test Maximum Leveled Power
A34 Rear Panel BNC	None	Full Self-Test
A36 DC Block (HP 83621A/31A)	None	Maximum Leveled Power
CR1 Detector	ALC Power Level Accuracy Power Flatness	Full Self-Test
FL1 Line Module	None	Full Self-Test
FL2 8 GHz LPF	Sampler Assembly	Full Self-Test
J1 RF Output Connector	Power Flatness (automated)	Full Self-Test Maximum Leveled Power
T1 Toroid Power Transformer	None	Full Self-Test

9

Replaceable Parts

Introduction

Replaceable parts include major assemblies and all chassis hardware. Table 9-1 lists reference designations and abbreviations used in this chapter.

For information on removing and replacing assemblies, see chapter 7, "Disassembly and Replacement Procedures".

Module–Exchange Program

Many major assemblies are covered by the module–exchange program. Under the terms of the program, factory–repaired and tested assemblies are available on a trade–in basis (a defective assembly *must* be returned for credit). Exchange assemblies meet all new assembly specifications, but are less expensive. Figure 9-1 illustrates the module exchange procedure.

Order spare assembly stock using the *new* assembly part number.

If you have any questions, contact your Hewlett–Packard customer engineer for the latest information about this program.

Replacement Information

The following information is given in the tables in this chapter:

- Hewlett–Packard part number.
- Part quantity for that figure. There may be more of that part in other figures.
- Part description (see Table 9-1 for abbreviations).

Ordering Information

For any listed part, request the Hewlett–Packard part number and quantity required from the nearest Hewlett–Packard office.

How To Order Parts ... Fast!

Hewlett–Packard parts specialists have direct on–line access to the replaceable parts listed in this manual. Four–day delivery is standard; there is a charge for hotline (one–day) delivery.

In the United States, call the following toll–free number:

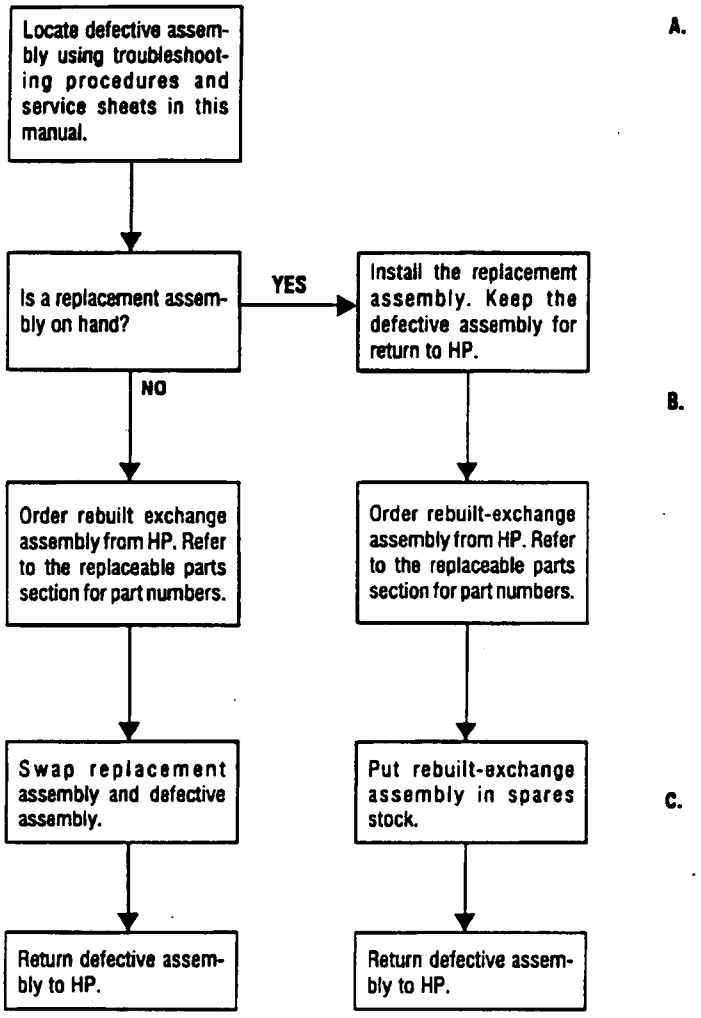
(800) 227–8164
Monday through Friday, 6 am to 5 pm (Pacific Standard Time)

Outside the United States, contact your nearest Hewlett–Packard office.

Table 9-1. Reference Designations and Abbreviations

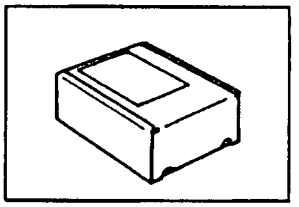
A	Amperage; Assembly
AT	Termination
AX	Axial Lead
AY	Assembly
B	Fan; Motor
BI	Bipin
BT	Battery
CHAM	Chamfer
CMPNT	Component
CONN	Connector
CR	Detector
CU	Copper
D	Diameter
DEG	Degree
F	Fuse
FE	Ferrule
FL	Filter
FLH	Flat Head
FLTG	Floating
FP	Front Panel
FR	Front
HD	Hand; Hard; Heavy Duty; Head
HEX	Hexadecimal; Hexagon; Hexagonal
ID	Inside Diameter
IN	Inch
INTL	Internal; International
J	Electrical Connector (Stationary Position); Jack
LBL	Label
LG	Long; Length
LK	Lock
LPF	Low Pass Filter
M	Male; Maximum; Meter; Mil; Milli
MTG	Mounting
NTD	Non-Time Delay
NYL	Nylon
PAN-HD	Pan Head
RF	Rear Panel
RPG	Rotary Pulse Generator
SKT	Socket
SN-PL	Tin Plated
SRD	Step Recovery Diode
STD	Standard
STL	Steel
SW	Switch
T	TransformerThickness; Taper; Tooth
TD	Time Delay
THD	Thread; Threaded
THK	Thick
TPG	Tapping
TR-HD	Truss Head
UL	Underwriters Laboratories
W	Cable; Wire
WD	Width
YIG	Yttrium Iron Garnate
YO	YIG Oscillator

Use this fast, efficient, economical method to keep your Hewlett-Packard instrument in service.


Locate defective assembly using troubleshooting procedures and service sheets in this manual.
Is a replacement assembly on hand?
YES
NO
Install the replacement assembly. Keep the defective assembly for return to HP.
Order rebuilt exchange assembly from HP. Refer to the replaceable parts section for part numbers.
Order rebuilt-exchange assembly from HP. Refer to the replaceable parts section for part numbers.
Swap replacement assembly and defective assembly.
Put rebuilt-exchange assembly in spares stock.
Return defective assembly to HP.
Return defective assembly to HP.

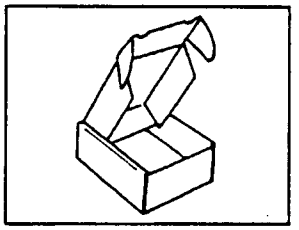
*HP pays postage on boxes mailed in U.S.A.

A.



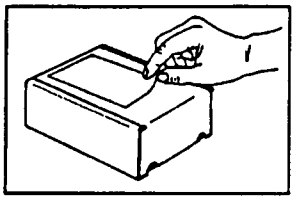
Rebuilt-exchange assemblies are shipped individually in boxes like this. In addition to the circuit assembly, the box contains:
Exchange assembly failure report
Return address label

B.



Open box carefully - it will be used to return defective assembly to HP. Complete failure report. Place it and defective assembly in box. Be sure to remove enclosed return address label.

C.



Seal box with tape. Inside U.S.A.*, stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label; instead address box to the nearest HP office.

Figure 9-1. Module Exchange Program

Table 9-2. Major Assemblies (1 of 2)

Ref. Desig.	HP Part Number	Qty	Description
A1			NOT USED
A2	08360-60002	1	SOURCE MODULE INTERFACE ASSEMBLY
A3			NOT USED
A4	08360-60010	1	FRACTIONAL-N ASSEMBLY
A4	08360-69010		FRACTIONAL-N ASSEMBLY (Rebuilt-Exchange)
A5	08360-60209	1	YO LOOP ASSEMBLY
A5	08360-69209		YO LOOP ASSEMBLY (Rebuilt-Exchange)
A6	08360-60007	1	SAMPLER ASSEMBLY
A6	08360-69007		SAMPLER ASSEMBLY (Rebuilt-Exchange)
A7	08360-60008	1	REFERENCE ASSEMBLY
A7	08360-69008		REFERENCE ASSEMBLY (Rebuilt-Exchange)
A8			NOT USED
A9	08360-60188	1	PULSE ASSEMBLY
A10	08360-60206	1	ALC ASSEMBLY
A10	08360-69206		ALC ASSEMBLY (Rebuilt-Exchange)
A11			NOT USED
A12	08360-60012	1	SYTM DRIVER ASSEMBLY (HP 83621A/31A)
A12	08360-69012		SYTM DRIVER ASSEMBLY (Rebuilt-Exchange)
A12	08360-60212	1	MULTIPLIER/FILTER DRIVER ASSEMBLY (HP 83651A)
A12	08360-69212		MULTIPLIER/FILTER DRIVER ASSEMBLY (Rebuilt-Exchange)
A13	08360-60213	1	YO DRIVER ASSEMBLY
A13	08360-69213		YO DRIVER ASSEMBLY (Rebuilt-Exchange)
A14	08360-60014	1	SWEEP GENERATOR ASSEMBLY
A14	08360-69014		SWEEP GENERATOR ASSEMBLY (Rebuilt-Exchange)
A15	08360-60215	1	CPU ASSEMBLY
A15	08360-69215		CPU ASSEMBLY (Rebuilt-Exchange)
	08360-60201	1	FIRMWARE UPGRADE KIT
A16	08360-60016	1	POSTREGULATOR ASSEMBLY
A16	08360-69016		POSTREGULATOR ASSEMBLY (Rebuilt-Exchange)
	0400-0018	1	GROMMET-CHAN .052 TH (Part of A16)
A16F1	2110-0047	1	FUSE (INCH) 1A 125V NTD BI
A16F2	2110-0618	3	FUSE (INCH) 5A 125V NTD BI
A16F3	2110-0713	2	FUSE-SUBMINIATURE 10A 125V NTD AX
A16F4	2110-0713		FUSE-SUBMINIATURE 10A 125V NTD AX
A16F5	2110-0618		FUSE (INCH) 5A 125V NTD BI
A16F6	2110-0618		FUSE (INCH) 5A 125V NTD BI
A16F7	2110-0425	2	FUSE (INCH) 2A 125V NTD BI
A16F8	2110-0425		FUSE (INCH) 2A 125V NTD BI
A17	08360-60017	1	RECTIFIER/FILTER ASSEMBLY
A17	08360-69017		RECTIFIER/FILTER ASSEMBLY (Rebuilt-Exchange)
A17F1	2110-0303	1	FUSE (INCH) 2A 250V TD FE UL
A18	08360-60018	1	SWITCHING REGULATOR ASSEMBLY
A18	08360-69018	1	SWITCHING REGULATOR ASSEMBLY (Rebuilt-Exchange)
A18F1	2110-0201	1	FUSE (INCH) 0.25A 250V TD FE UL

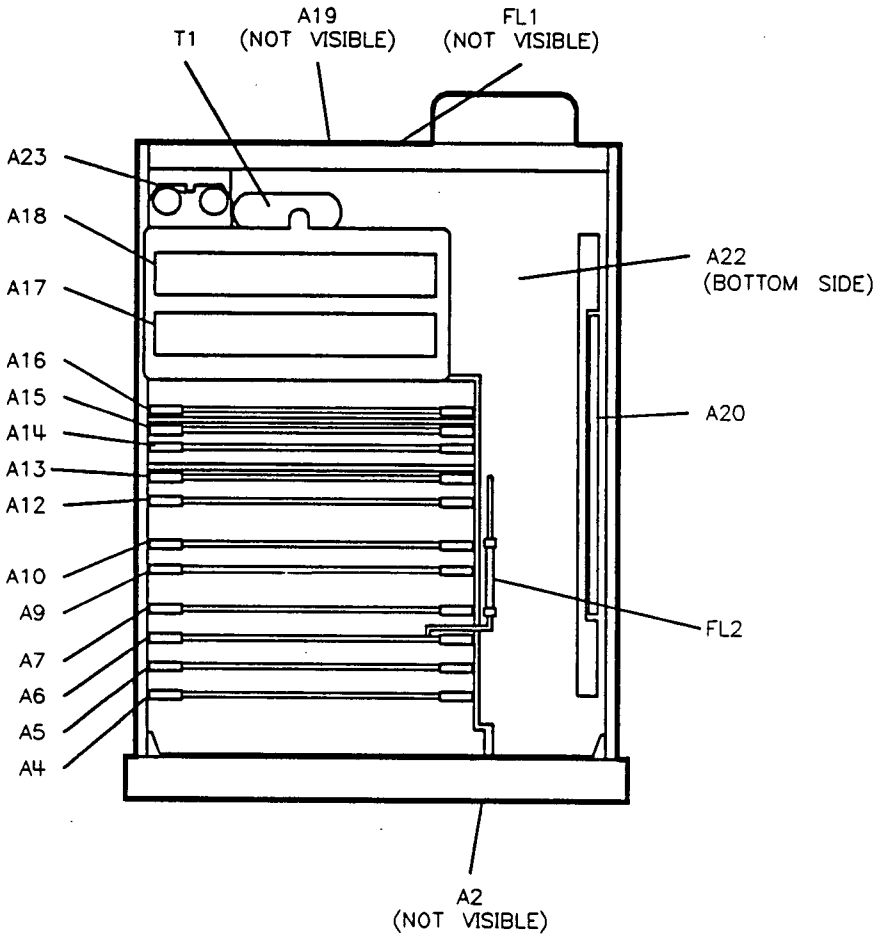
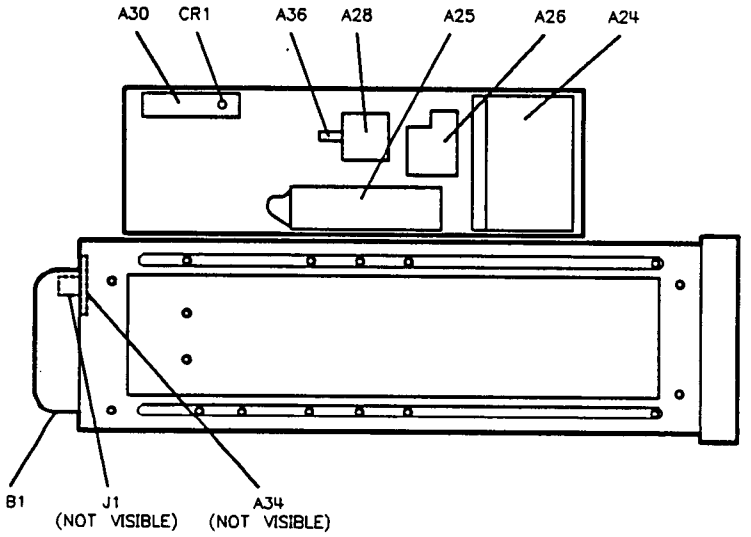


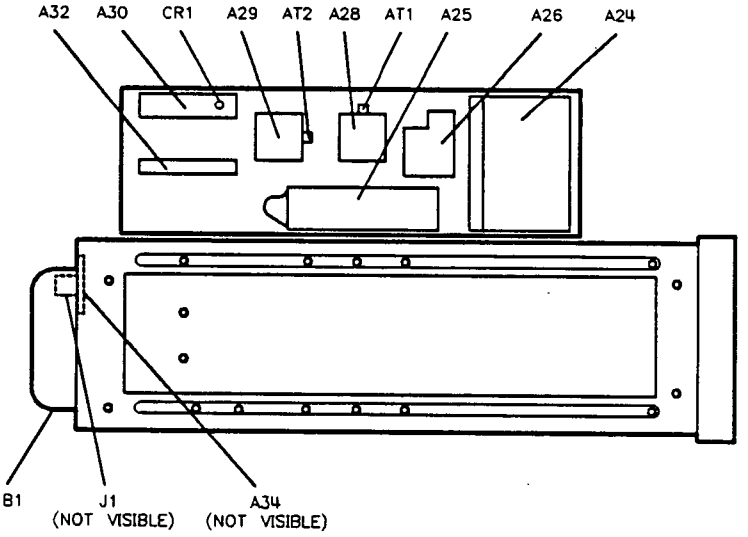
Figure 9-2. Major Assemblies (1 of 2)

Table 9-2. Major Assemblies (2 of 2)

Ref. Desig.	HP Part Number	Qty	Description
A19	08360-60019	1	REAR PANEL INTERFACE ASSEMBLY
A20	08360-60187	1	RF INTERFACE ASSEMBLY
A20F1	2110-0425	1	FUSE (INCH) 2A 125V NTD BI
A21			NOT USED
A22	08360-60196	1	MOTHERBOARD ASSEMBLY
A23	10811E	1	10 MHZ REFERENCE STANDARD (Includes W30)
A24	5086-7463	1	LOWBAND ASSEMBLY
A24	5086-6463		LOWBAND ASSEMBLY (Rebuilt-Exchange)
A25	5086-7464	1	MODULATOR/SPLITTER
A25	5086-6464		MODULATOR/SPLITTER (Rebuilt-Exchange)
A26	5086-7515	1	YIG OSCILLATOR (2.0 - 7.5 GHz)
A26	5086-6515		YIG OSCILLATOR (2.0 - 7.5 GHz) (Rebuilt-Exchange)
A27			NOT USED
A28	5086-7596	1	SWITCHED AMPLIFIER MULTIPLIER (HP 83621A/31A)
A28	5086-6596	1	SWITCHED AMPLIFIER MULTIPLIER (Rebuilt—Exchange)
A28	5086-7585	1	AMPLIFIER/MULTIPLIER (HP 83651A)
A28	5086-6585		AMPLIFIER/MULTIPLIER (Rebuilt-Exchange)
A29	5086-7586	1	AMPLIFIER/FILTER (HP 83651A)
A29	5086-6586		AMPLIFIER/FILTER (Rebuilt-Exchange)
A30	0955-0148	1	μWAVE DIRECTIONAL COUPLER 20 GHZ MAX (HP 83621A)
A30	0955-0125	1	μWAVE DIRECTIONAL COUPLER 26.5 GHZ MAX (HP 83631A)
A30	0955-0523	1	μWAVE DIRECTIONAL COUPLER 50 GHZ MAX (HP 83651A)
A31			NOT USED
A32	5086-7513	1	DOUBLER/AMPLIFIER (HP 83651A)
A33			NOT USED
A34	08360-60157	1	RP FLOATING BNC ASSEMBLY
A35			NOT USED
A36	11742A	1	DC BLOCKING CAPACITOR (HP 83621A/31A)
AT1	0960-0053	1	TERMINATION SMA MALE 50Ω
AT2	0960-0053	1	TERMINATION SMA MALE 50Ω
B1	08360-60006	1	FAN
CR1	08360-60147	1	DETECTOR REPLACEMENT KIT (HP 83621A/31A)
CR1	08360-60203	1	DETECTOR REPLACEMENT KIT (HP 83651A)
F1	2110-0227	1	FUSE (INCH) 5A 250V NTD FE UL
F1	2110-0003	1	FUSE (INCH) 3A 230V NTD FE UL
FL1	9135-0242	1	LINE MODULE - FILTERED
FL2	0955-0485	1	8 GHZ LOW PASS FILTER
J1	08673-60040	1	RF OUTPUT CONNECTOR (HP 83621A/31A)
J1	5062-6610	1	RF OUTPUT CONNECTOR (HP 83651A)
T1	9100-4781	1	TOROID POWER TRANSFORMER



HP 83621A/31A



HP 83651A

Figure 9-2. Major Assemblies (2 of 2)

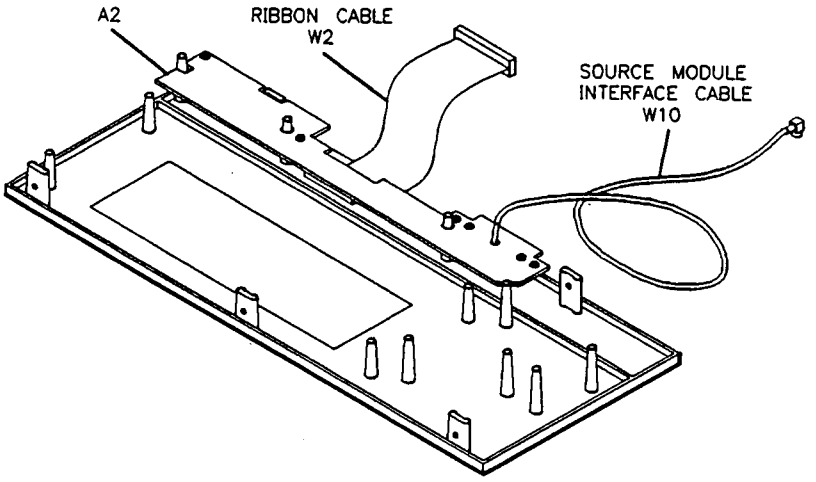


Figure 9-3. Cables (1 of 4)

Table 9-3. Cables (1 of 2)

Ref. Desig.	HP Part Number	Qty	Description
W1			NOT USED
W2	08360-60056	1	SMI/MOTHERBOARD-A2J1/A22J1
W3-W9			NOT USED
W10	08360-60092	1	FP SMI LEVELING-A2J2/A10J2
W11	08360-60074	1	125 KhZ REF-A7J3/A4J1
W12	08360-60075	1	30-60 MHZ-A4J2/A5J2
W13	08360-60076	1	SAMPLER IF-A6J2/A5J1
W14	08360-60083	1	HIGH FREQ PLL-A5J3/A26J2
W15	08360-60072	1	40 MHZ REF-A7J6/A6J1
W16	08360-60095	1	EXTERNAL STD-J6/A7J1
W17	08360-60071	1	OVEN STD-A23J1/A7J2
W18	08360-60073	1	1 MHZ-A7J4/A14J1
W19	08360-60096	1	10 MHZ REAR PANEL -A7J5/J7
W20	08360-60082	1	100 MHZ REF-A7J7/A24J2
W21			NOT USED
W22			NOT USED
W23	08360-60093	1	RP SMI LEVELING-A19J2/A10J3
W24	08360-60107	1	LOWBAND DETECTOR-A24J3/A10J5
W25	08360-60106	1	HI BAND DETECTOR-CR1/A10J7
W26			NOT USED
W27	08360-60097	1	V/GHZ-A12J1/J10
W28	08360-60098	1	TRIGGER OUTPUT-A14J2/J9
W29	08360-60031	1	PREREG IN/PREREG OUT-A18J1/A17J1
W30	08360-60063	1	MOTHERBOARD/10MHZ STD-A22J7/A23J2
W31	08360-60037	1	REAR PANEL/MOTHERBOARD-A19J1/A22J8

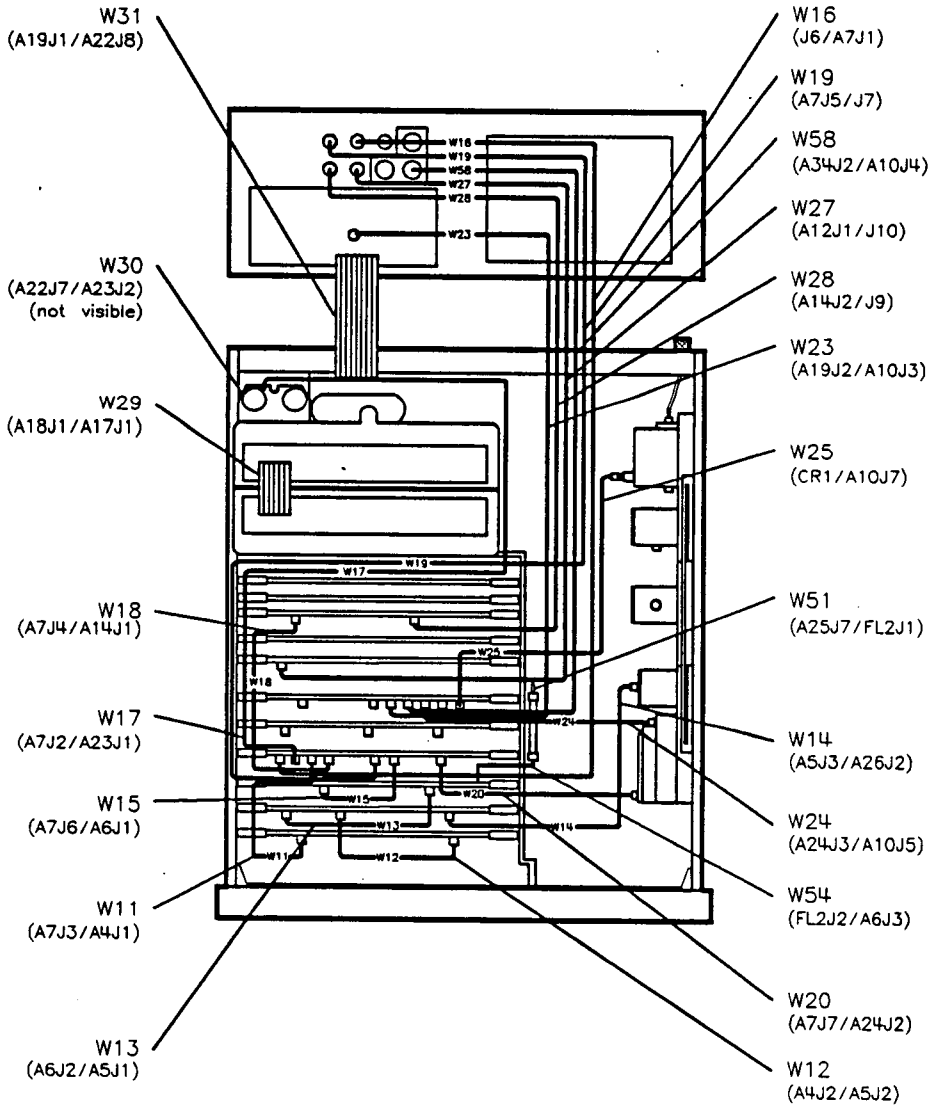


Figure 9-3. Cables (2 of 4)

Table 9-3. Cables (2 of 2)

Ref. Desig.	HP Part Number	Qty	Description
W32	08360-60090	1	PULSE MOD HI-A22J3/A25J3
W33	08360-60088	1	PULSE MOD LO-A22J4/A24J6
W34	08360-60087	1	ALC MOD LOW-A22J5/A24J7
W35	08360-60089	1	ALC MOD HI-A22J6/A25J2
W36	08360-60191	1	RF INTERFACE/DOUBLER-A20J5/A32J1 (HP 83651A)
W37	08360-60189	1	RF INTERFACE/AMP MULT-A20J9/A28J1
W37	08360-60179	1	RF INTERFACE/SWITCHED AMP MULT-A20J9/A28J1
W38	08360-60043	1	RF INTERFACE/MOD SPLTR-A20J3/A25J1 (HP 83621A/31A)
W38	08360-60043	1	RF INTERFACE/MOD SPLTR-A20J2/A25J1 (HP 83651A)
W39	08360-60046	1	RF INTERFACE/LOWBAND-A20J4/A24J1
W40			NOT USED
W41	08360-60190	1	RF INTERFACE/AMP FILTER-A20J8/A29J1 (HP 83651A)
W42	08360-60040	1	RF INTERFACE/YO-A20J8/A26J1 (HP 83621A/31A)
W42	08360-60040	1	RF INTERFACE/YO-A20J10/A26J1 (HP 83651A)
W43	08360-20073	1	DIR COUPLER/RF OUT-A30J2/J1 (HP 83621A/31A)
W43	08360-20083	1	DIR COUPLER/RF OUT-A30J2/J1 (HP 83651A)
W44			NOT USED
W45	08360-20168	1	DC BLOCK/DIR COUPLER-A36J2/A30J1 (HP 83621A/31A)
W46			NOT USED
W47	08360-20167	1	LOWBAND/AMP MULT-A24J4/A28J4 (HP 83621A/31A)
W47	08360-20139	1	LOWBAND/DOUBLER-A24J4/A32J3 (HP 83651A)
W48			NOT USED
W49	08360-20157	1	MOD SPLIT/AMP MULT-A25J6/A28J2 (HP 83621A/31A)
W49	08360-20165	1	MOD SPLIT/AMP MULT-A25J6/A28J2 (HP 83651A)
W50	08360-20063	1	MOD SPLIT/LOWBAND-A25J5/A24J5
W51	08360-20117	1	MOD SPLIT/LPF-A25J7/FL2J1
W52	08360-20060	1	YO/MOD SPLIT-A26J4/A25J4
W53			NOT USED
W54	08360-20087	1	LPF/SAMPLER-FL2J2/A6J3 - See Figure 9-3 (2 of 3)
W55	08360-20138	1	DOUBLER/COUPLER-A32J4/A30J1 (HP 83651A)
W56	08360-20137	1	AMP FILTER/DOUBLER-A29J3/A32J20 (HP 83651A)
W57			NOT USED
W58	08360-60099	1	EXTERNAL LEVELING A34J2/A10J4 - See Figure 9-3 (2 of 3)
W59			NOT USED
W60			NOT USED
W61	08360-20158	1	AMP MULT/AMP FILTER-A28J3/A29J2 (HP 83651A)

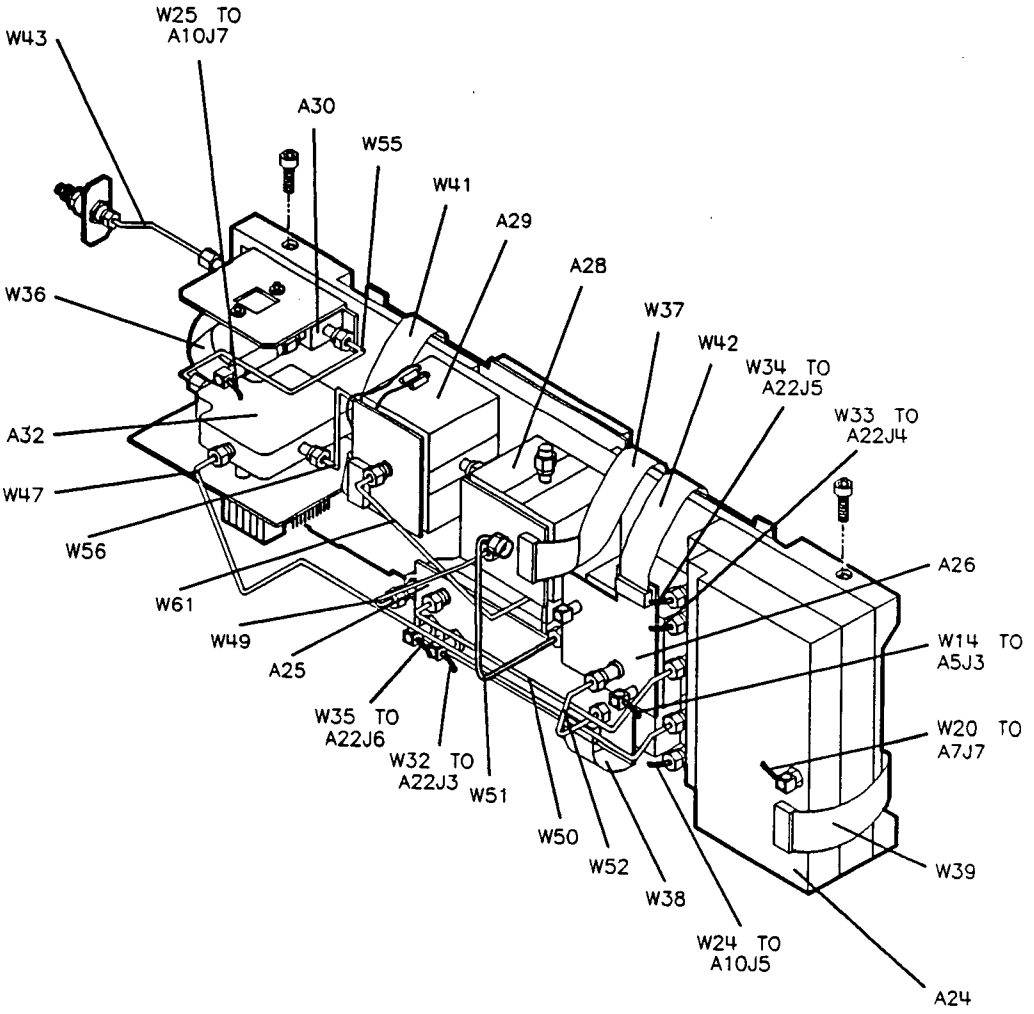


Figure 9-3. Cables - HP 83651A RF Deck (3 of 4)

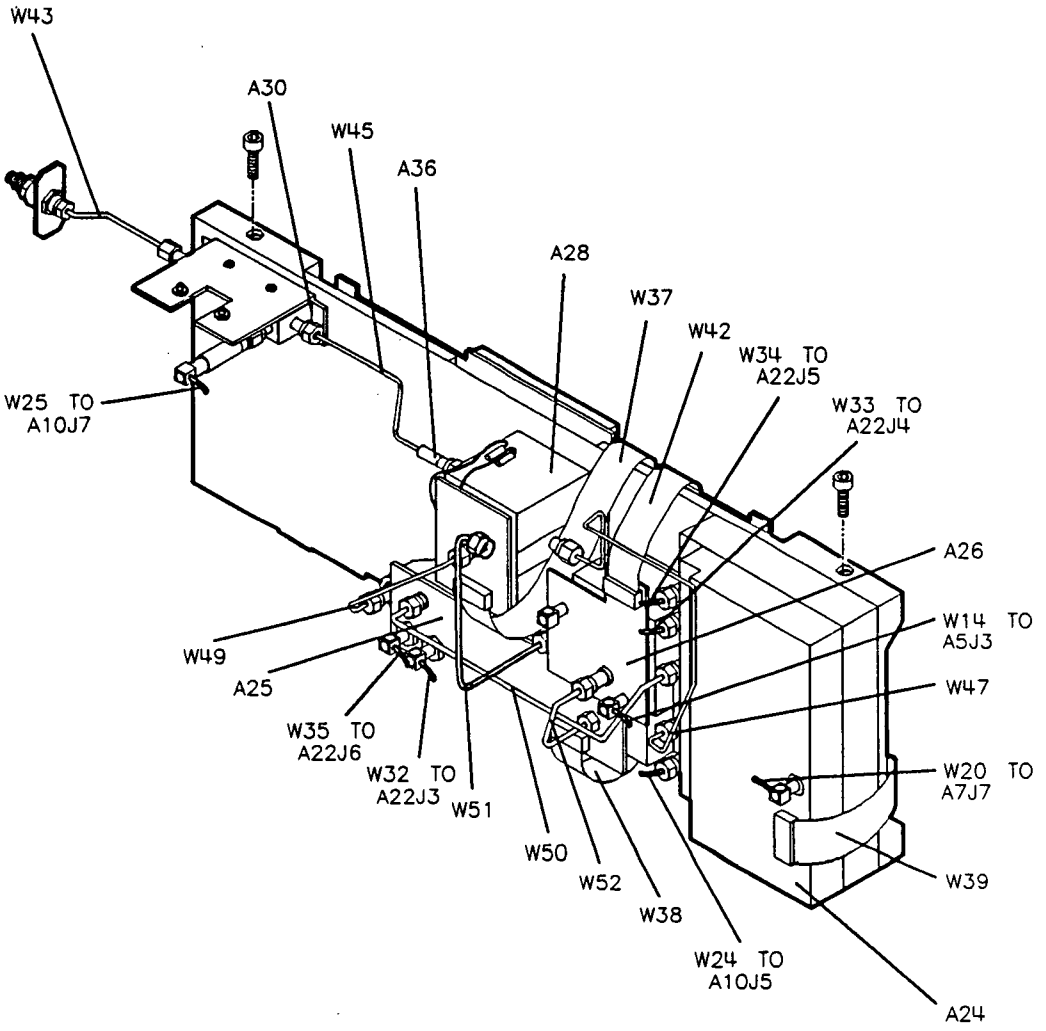


Figure 9-3. Cables - HP 83621A/31A RF Deck (4 of 4)

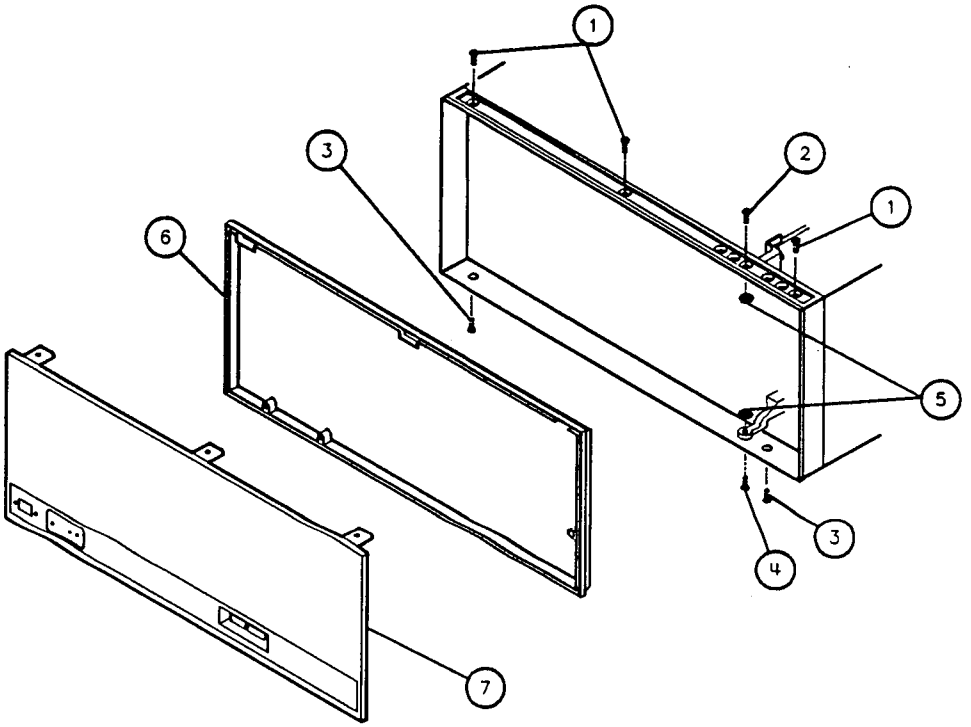


Figure 9-4. Front Panel

Table 9-4. Front Panel

Ref. Desig.	HP Part Number	Qty	Description
1	0515-2043	3	SCREW-MACH. M4 x 0.7 8MM-LG 90-DEG-FLH-HD
2	0515-0943	2	SCREW-MACH. M4 x 0.7 12MM-LG
	0535-0082	2	NUT-SPECIALTY M3.5 x 1.27 THD; 8.44MM
3	0515-2043	2	SCREW-MACH. 8MM-LG 90-DEG-FLH-HD
4	0515-0943		SCREW-MACH. M4 x 0.7 12MM-LG
5	0535-0082	2	NUT-SPECIALTY M3.5 x 1.27 THD; 8.44MM
6	08360-40004	1	RFI SEAL (BLACK RUBBER GASKET)
7	08360-20052	1	FRONT PANEL CASTING Also order front panel nameplate in "Miscellaneous Replaceable Accessories"

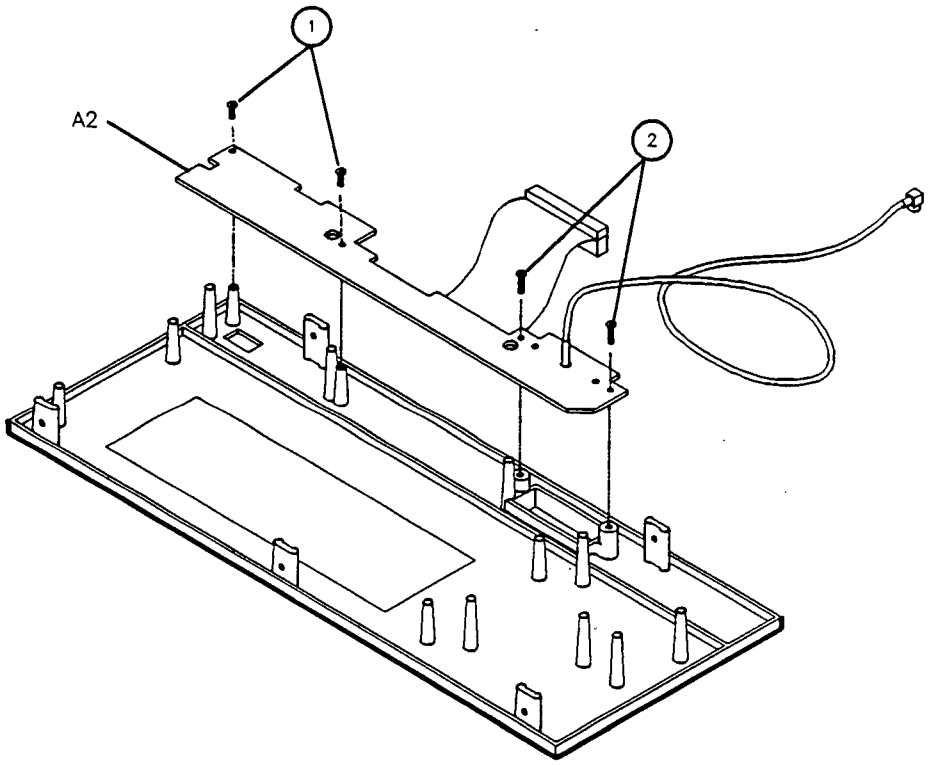


Figure 9-5. Front Panel, Attaching Hardware

Table 9-5. Front Panel, Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	0515-0372	2	SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
2	0515-0664	2	SCREW-MACHINE ASSEMBLY M3 x 0.5 12MM-LG

Table 9-6. Rear Panel

Ref. Desig.	HP Part Number	Qty	Description
1	08360-00001	1	REAR PANEL
2	0515-0372	5	SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
3			BNC CONNECTOR (Order A34 of Table 9-2)
4	6960-0027	4	PLUG-HOLE TR-HD FOR .625-D-HOLE NYL
5	6960-0041	1	PLUG-HOLE TR-HD FOR .5-D-HOLE NYL
6			J6 - CA AY-10MHZ IN-See Table 9-3
	2950-0035	4	NUT-HEX DBL-CHAM 15/32-32-THD
	2190-0102	4	WASHER LK INTL T 15/32 IN .472-IN-ID
7			J10 - CA AY-VOLTS/GHZ-See Table 9-3
	2950-0035		NUT-HEX DBL-CHAM 15/32-32-THD
	2190-0102		WASHER LK INTL T 15/32 IN .472-IN-ID
8			J7 - CA AY-10MHZ OUT-See Table 9-3
	2950-0035		NUT-HEX DBL-CHAM 15/32-32-THD
	2190-0102		WASHER LK INTL T 15/32 IN .472-IN-ID
9			J9 - CA AY-ANAL INTFC-See Table 9-3
	2950-0035		NUT-HEX DBL-CHAM 15/32-32-THD
	2190-0102		WASHER LK INTL T 15/32 IN .472-IN-ID
10	0515-0380	8	SCREW-MACHINE ASSEMBLY M4 x 0.7 10MM-LG
11			BNC CONNECTOR (Order A19 of Table 9-2)
12	0380-0643	2	STANDOFF HEX .255-IN-LG 6/32-THD
13	1251-5436	4	SCREW LOCK KIT-AMP HD CONN
14	0515-0372	7	SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
15	0515-1037	2	SCREW-MACHINE ASSEMBLY M3 x 0.5 45MM-LG
16			LINE MODULE - FILTERED (See Table 9-2)
17			HP-IB SWITCH (Order A19 of Table 9-2)
18	08360-60032	1	AC VOLTAGE SELECTION SWITCH/HARNESS
19			FAN (see Table 9-2)
20			RF CONNECTOR, CONNECTOR PLATE AND HARDWARE (see Table 9-13)
F1	2110-0227	1	FUSE (INCH) 5A 250V NTD FE UL
	2110-0003	1	FUSE (INCH) 3A 230V NTD FE UL
	2110-0564	1	FUSEHOLDER BODY
	2110-0565	1	FUSEHOLDER CAP
	2110-0569	1	FUSEHOLDER NUT

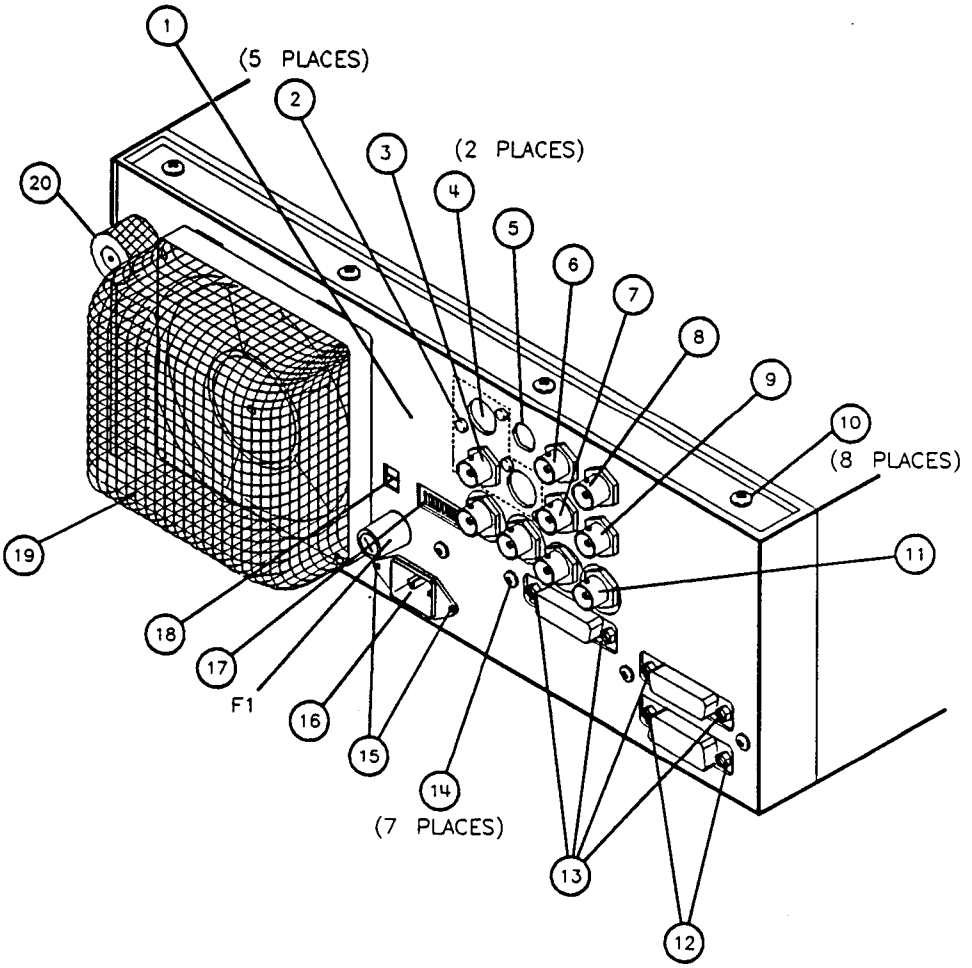


Figure 9-6. Rear Panel

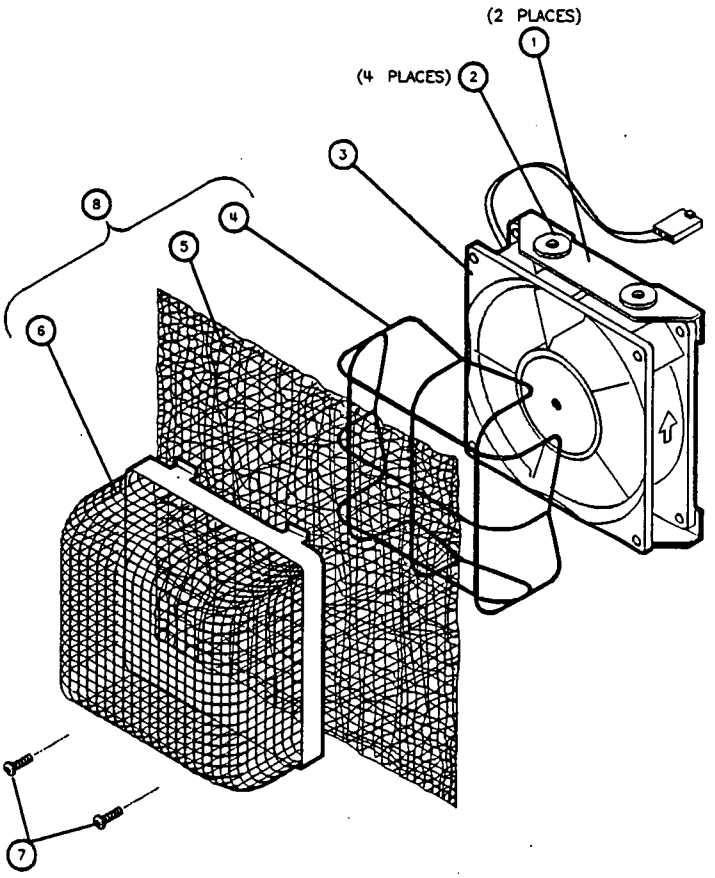


Figure 9-7. Rear Panel Fan Assembly

Table 9-7. Rear Panel Fan Assembly

Ref. Desig.	HP Part Number	Qty	Description
1	08360-00016	2	FAN MOUNT
2	1520-0230	4	SHOCK MOUNT .27-EFF-HGT 2-LB-LOAD-CAP
3	08360-80006	1	FAN (B1)
4		1	SUPPORT-FILTER FOAM (Not available separately)
5	08360-20109	1	FOAM FILTER
6		1	FAN CAGE (Not available separately)
7	0515-0372	2	SCREW-MACHINE ASSY M3X 0.5 8MM-LG
8	08360-60123	1	KIT - FAN FILTER ASSEMBLY (Includes fan cage, foam filter, and support-filter foam)

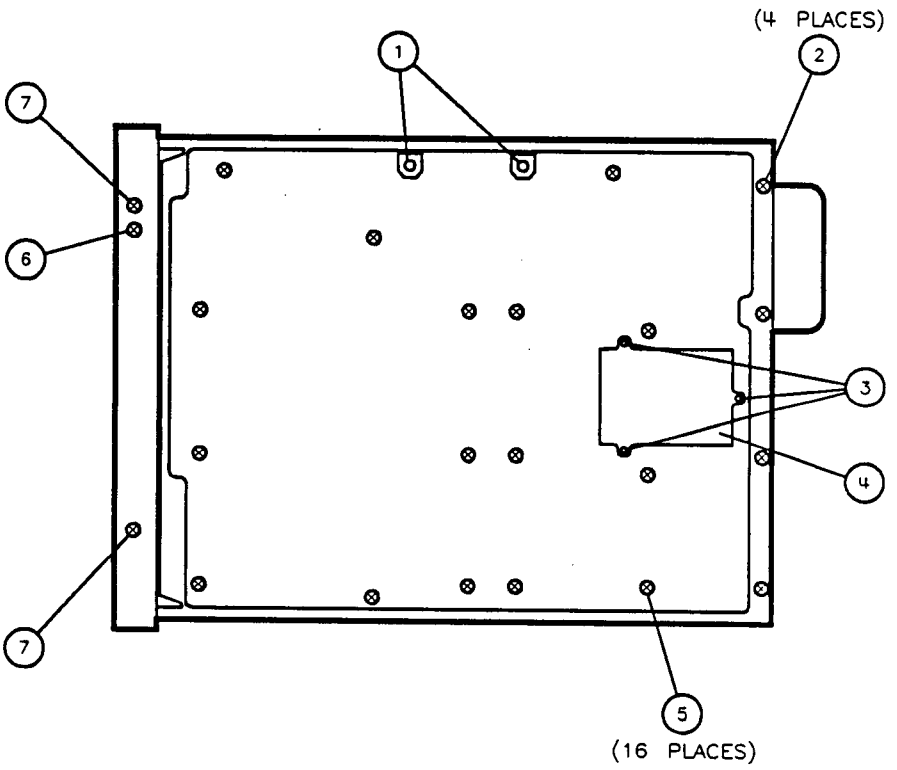


Figure 9-8. Bottom View, Attaching Hardware

Table 9-8. Bottom View, Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	6960-0016	2	PLUG-HOLE TR-HD FOR .125-D HOLE NYL
2			SCREW-MACHINE (See Table 9-6)
3	0624-0518	3	SCREW-TPG 6-19 .25-IN-LG PAN-HD-TORX T15
4	08360-40002	1	HIGH VOLTAGE COVER
5	0515-0382	16	SCREW-MACHINE ASSEMBLY M4 x 0.7 12MM-LG
6			SCREW-MACHINE (See Table 9-4)
7			SCREW-MACHINE (See Table 9-4)

Table 9-9. Top View, Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	08360-00015	1	POWER SUPPLY HOUSING
2			SCREW-MACHINE (See Table 9-7)
3	08360-20044	1	END SUPPORT
4	0515-0501	2	SCREW-SKT-HD-CAP M6 x 1.0 12MM-LG
5	08360-00008	1	MOUNTING BRACKET (COUPLER/DETECTOR) (HP 83621A/31A)
5	08360-00009	1	MOUNTING BRACKET (COUPLER/DETECTOR) (HP 83651A)
6	0515-0372	2	SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
7	0520-0128	2	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI
8	2190-0112	2	WASHER-LK HLCL NO. 2 .088-IN-ID(HP 83621A/31A)
9	08360-00035	1	SUPPORT CONNECTORS
10	1400-0755	1	CLIP CMPNT .25-DIA .75-WD PVC (Holds FL2)
11	08360-20042	1	CARD CAGE SUPPORT
12			SCREW-MACHINE (See Table 9-4)
13			SCREW-MACHINE (See Table 9-4)
14	08360-20043	3	DIVIDERS
15	8160-0539		RFI ROUND STRIP CU-CLD-STL SN-PL (2.56 FT)
16	0515-0382	6	SCREW-MACHINE ASSEMBLY M4 x 0.7 12MM-LG
17	08360-40004		RFI SEAL (3 FT)
18	08360-20045	1	POWER SUPPLY COVER
19	2200-0103	2	SCREW-MACH. 4-40 .25-IN-LG PAN-HD-POZI
	2190-0105	2	WASHER-LK HLCL NO. 6 .141-IN-ID
	1520-0205	3	SHOCK MOUNT .31-EFF-HGT

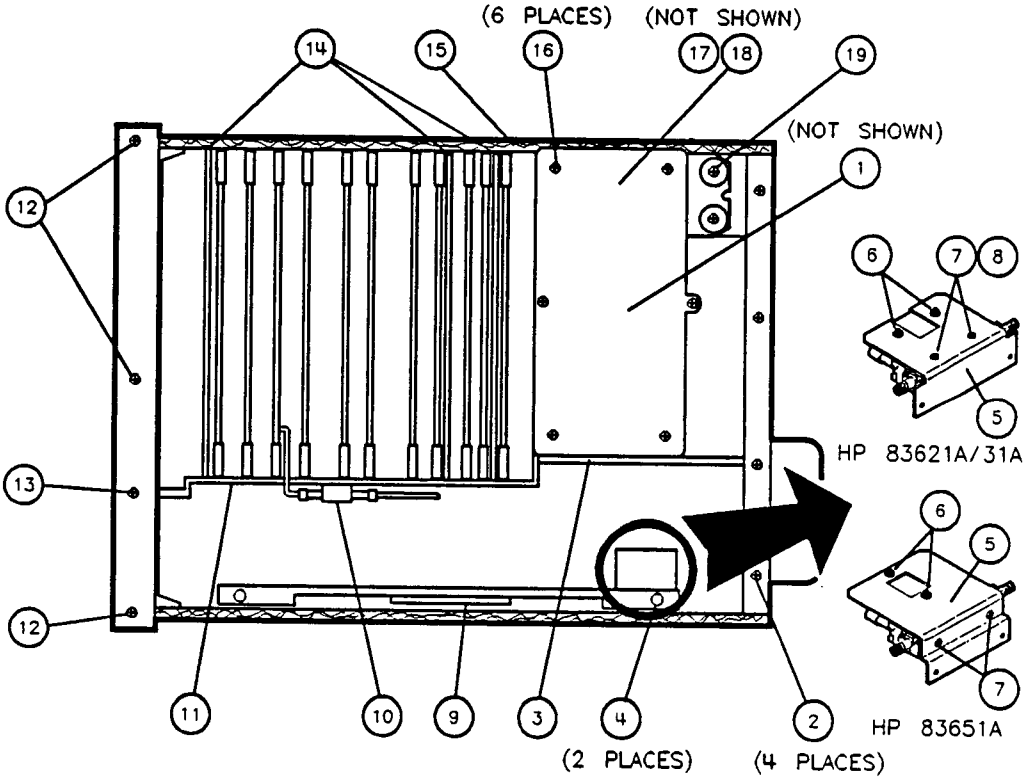


Figure 9-9. Top View, Attaching Hardware

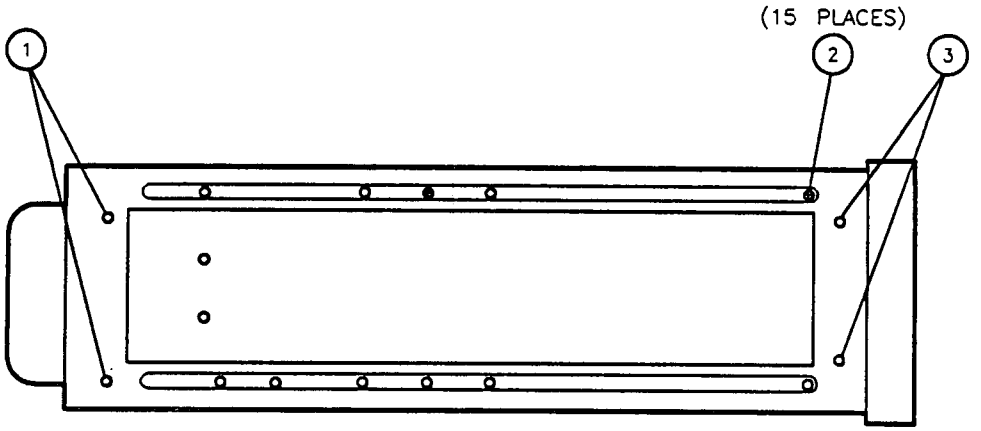
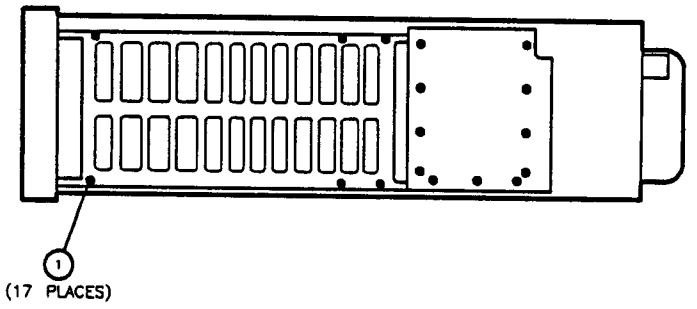


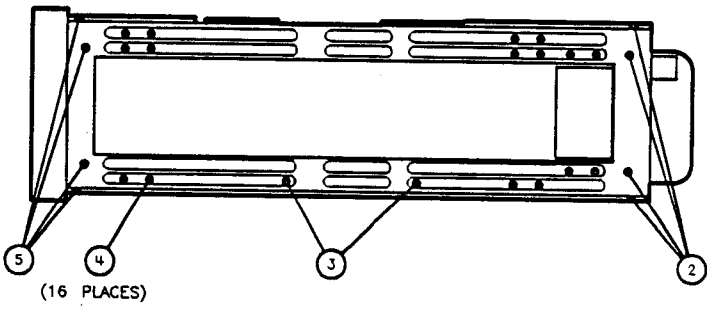
Figure 9-10. Left Side View, Attaching Hardware

Table 9-10. Left Side View, Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	0515-2086	4	SCREW-SPCL M4 x 0.7 7MM-LG 90-DEG-FLH-HD
2	0515-0382	15	SCREW-MACHINE ASSEMBLY M4 x 0.7 12MM-LG
3	0515-2086		SCREW-SPCL M4 x 0.7 7MM-LG 90-DEG-FLH-HD



CARDCAGE AND REGULATOR BOX SCREWS

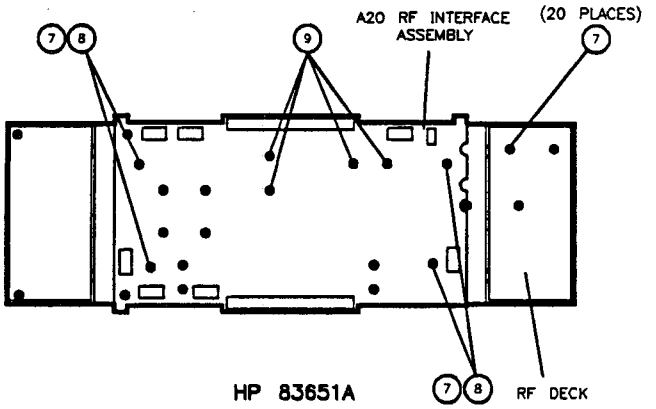


CHASSIS SCREWS

Figure 9-11. Right Side View, Attaching Hardware

Table 9-11. Right Side View, Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	0515-0382	33	SCREW-MACHINE ASSEMBLY M4 x 0.7 12MM-LG
2	0515-2086	8	SCREW-SPCL M4 x 0.7 7MM-LG 90-DEG-FLH-HD
3	0515-0433	2	SCREW-MACHINE ASSEMBLY M4 x 0.7 8MM-LG
4	0515-0382		SCREW-MACHINE ASSEMBLY M4 x 0.7 12MM-LG
5	0515-2086		SCREW-SPCL M4 x 0.7 7MM-LG 90-DEG-FLH-HD



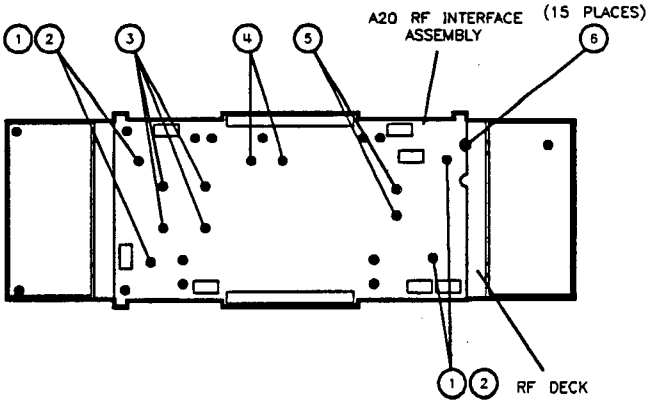


Figure 9-12. RF Deck Right Side View, Attaching Hardware

Table 9-12. RF Deck Right Side View, Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	0515-0372	39	SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
2	3050-0169	8	WASHER-SPR CRVD NO.6 .143-IN-ID
3	0515-2011	6	SCREW-MACHINE ASSEMBLY M3.5 x 0.6
4	2200-0105	2	SCREW-MACHINE 4-40 .312-IN-LG PAN-HD-POZI
5	0515-2011		SCREW-MACHINE ASSEMBLY M3.5 x 0.6
6	0515-0372		SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
7	0515-0372		SCREW-MACHINE ASSEMBLY M3 x 0.5 8MM-LG
8	3050-0169		WASHER-SPR CRVD NO.6 .143-IN-ID
9	2360-0117	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI

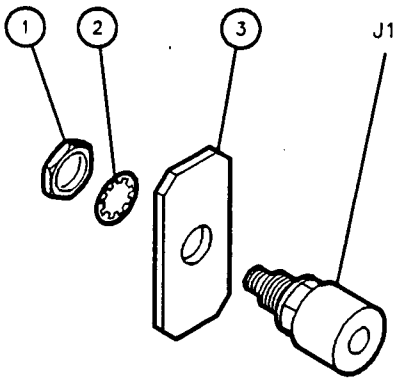


Figure 9-13. RF Connector and Attaching Hardware

Table 9-13. RF Connector and Attaching Hardware

Ref. Desig.	HP Part Number	Qty	Description
1	08360-20133	1	NUT-HEX-DBL-CHAM 3/8-32-THD
2	2190-0016	1	WASHER-LK INTL 3/8 IN
3	08360-00024	1	RF CONNECTOR PLATE - 2.4
J1			RF CONNECTOR (See Table 9-2)

Table 9-14. Chassis Parts

Ref. Desig.	HP Part Number	Qty	Description
1	5062-3736	1	COVER-TOP
2	0515-1245	1	SCREW - COVER
3	5021-5838	2	SIDE RAILS
4	5041-8802	1	TRIM STRIP
5	5021-8405	1	FRONT FRAME
6	5062-3800	2	HANDLE ASSEMBLY
7	0515-0943	4	HANDLE SCREWS
8	5021-8497	2	TRIM FRONT HANDLE
9	5041-8801	4	FOOT -FM .5M
10	5062-3748	1	COVER-BOTTOM
11	1460-1345	2	TILT STAND
12	5062-3843	2	COVER-SIDE
13	5041-8819	2	CAP-FRONT
14	0515-0707	4	STRAP SCREW
15	5041-8820	2	CAP-REAR
16	5062-3705	2	STRAP HANDLE
17	08360-20040	1	SIDE FRAME
18	5021-5806	1	REAR FRAME
19	54110-40502	4	FOOT REAR
20	0515-1444	4	SCREW - REAR FOOT

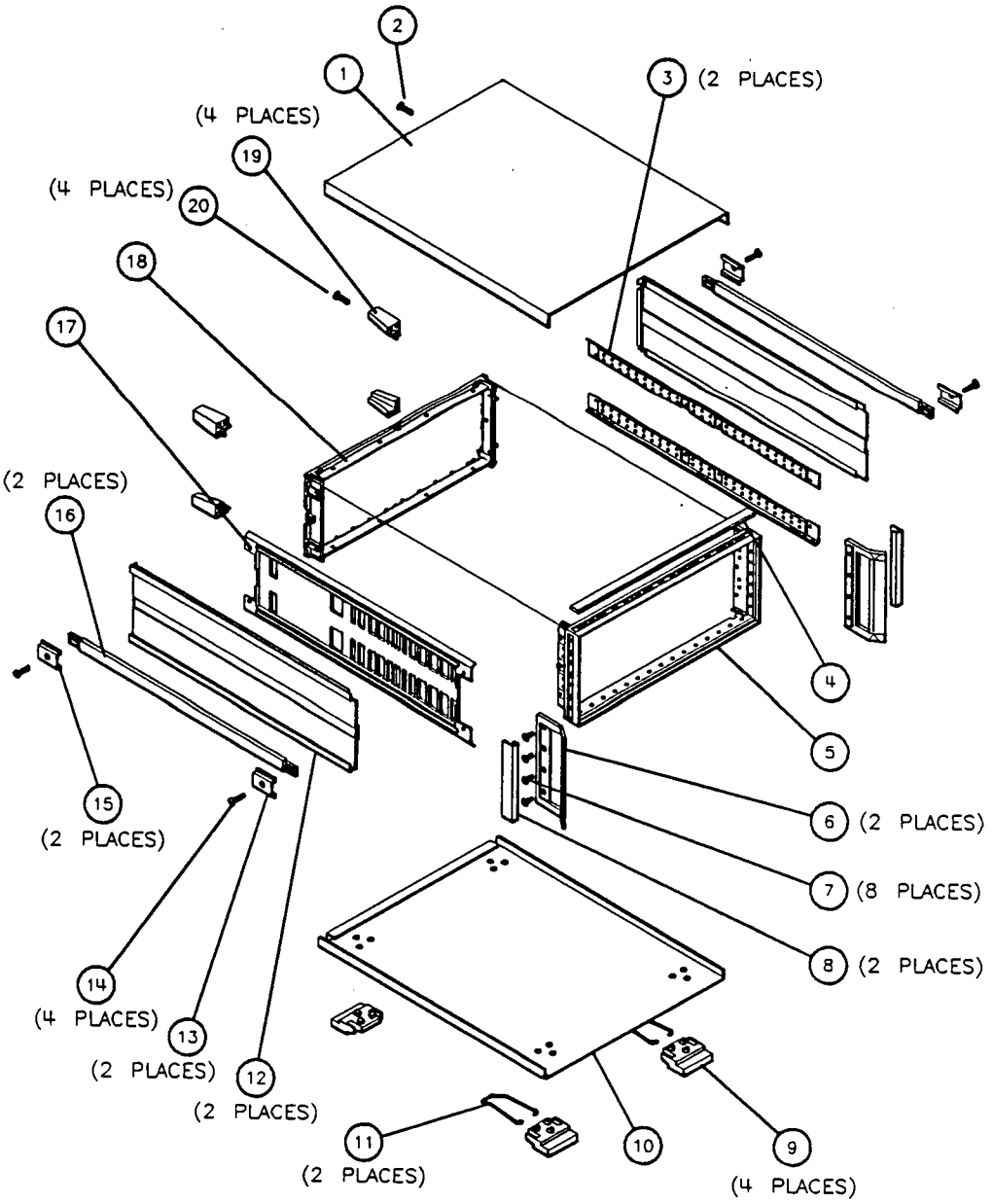


Figure 9-14. Chassis Parts

Table 9-15. Miscellaneous Replaceable Accessories (1 of 2)

Ref. Desig.	HP Part Number	Qty	Description
			LABELS
	7120-3737	1	LBL WRN HI VOLT
	83621-80001	1	NAMEPLATE 83621A
	83631-80001	1	NAMEPLATE 83631A
	83651-80001	1	NAMEPLATE 83651A
			SERVICE TOOLS
			T-10 TORX SCREWDRIVER
			T-15 TORX SCREWDRIVER
			#1 x 3 1/8 IN. POZIDRIV SCREWDRIVER
			#2 x 4 IN. POZIDRIV SCREWDRIVER
			5.5 MM NUT DRIVER
			7 MM NUT DRIVER
			.050 HEX DRIVER
			9/16 IN. NUT DRIVER
			5/16 IN OPEN END WRENCH
			14MM OPEN END WRENCH
	1251-2170		COAX EXTRACTOR TOOL-SUBMIN D CONNECTOR
	08360-60065		SUBSTITUTE FRONT PANEL
	08360-60060		TOOL KIT
			(Includes the following)
	08360-60086		EXTENDER BOARD-DIGITAL BOARDS
	08360-60085		EXTENDER BOARD-ANALOG BOARDS
	08360-60081		EXTENDER BOARD-POST REGULATOR
	08360-60077		EXTENDER BOARD-SWITCHING REGULATOR
	08360-60030		EXTENDER BOARD-RECTIFIER/FILTER
	08360-60084		EXTENDER BOARD-RF DECK
	08360-60105		EXTENDER CABLE-SMA (RF DECK)
	08360-60108		EXTENDER CABLE-POWER SUPPLY
	8710-1787		5 MM HEX BALL DRIVER
			ACCESSORIES
			TOUCH-UP PAINT
	6010-1146		DOVE GRAY - FOR FRAME AROUND FRONT PANEL & PAINTED PORTIONS OF FRONT HANDLES
	6010-1147		FRENCH GRAY - FOR SIDE, TOP, & BOTTOM COVERS
	6010-1148		PARCHMENT GRAY - FOR RACK MOUNT FLANGES, RACK SUPPORT SHELVES, & FRONT PANEL
			PC BOARD EXTRACTORS
	0403-0621	1	BLACK
	0403-0630	1	BROWN
	0403-0627	1	RED
	0403-0628	1	ORANGE
	0403-0622	1	YELLOW
	0403-0623	1	GREEN
	0403-0629	1	BLUE
	0403-0624	1	VIOLET
	0403-0625	1	GRAY
	0403-0626	1	WHITE
			SOFTWARE
	08360-10002	1	83621A/31A/51A SERVICE SUPPORT SOFTWARE CONTAINS: TWO 3.5-INCH DISKS, ONE DISK HOLDER
	08510-60022	1	8510/8360 FRONT PANEL EMULATOR ASSEMBLY

Table 9-15. Miscellaneous Replaceable Accessories (2 of 2)

Ref. Desig.	HP Part Number	Qty	Description
			DOCUMENTATION
	08360-90048		TROUBLESHOOTING MANUAL
	08360-90052		SERVICE MANUAL (8510 MODELS)
	08360-90049		SERVICE MANUAL
	08360-90070		USER'S HANDBOOK
	08360-90071		QUICK REFERENCE GUIDE
	08360-90053		8360 SERIES COMPLETE MANUAL SET (Includes all models)
	08360-90054		8360 SERIES MANUAL SET (8510 MODELS)
	08360-90055		8360 SERIES MANUAL SET
	5954-1566		CONNECTOR CARE APPLICATION NOTE

10

Preventive Maintenance

Introduction

This chapter contains the following information on care and maintenance of the synthesizer:

- How To Clean the Fan Filter.
- How To Replace the Fan Filter.
- How To Replace the Line Fuse.
- Connector Care.

How To Clean the Fan Filter

The cooling fan, located on the rear panel, has a thin foam filter. How often the filter must be cleaned depends on the environment in which the synthesizer operates. As the filter collect dust, the fan speed increases to maintain airflow (as the fan speed increases, so does the fan noise). If the filter continues to collect dust after the fan reaches maximum speed, airflow is reduced and the synthesizer's internal temperature increases. If the internal temperature reaches 90°C, the synthesizer automatically turns off and the amber standby LED turns on. Clean the fan filter as follows:

1. Turn off the synthesizer.
2. Remove the AC line cord.
3. Remove the screws holding the fan cage (see Figure 10-1).
4. Remove the fan cage from the rear panel.
5. Rinse the fan cage, filter, the filter retainer in warm water, then dry.
6. Reverse the removal procedure to reassemble the synthesizer.

How To Replace the Fan Filter

Use the following procedure to replace the cooling fan filter:

1. Turn off the synthesizer.
2. Remove the AC line cord.
3. Remove the screws holding the fan cage (see Figure 10-1).
4. Remove the fan cage from the rear panel and gently pry the filter retainer from the fan cage.
5. Remove and discard the old fan filter.
6. Fit the new filter into the fan cage covering the entire area. Carefully replace the filter retainer without misaligning or creating folds in the filter.
7. Cut the corners of the filter to create an even edge all around the fan cage.
8. Reverse steps 1 through 3 to reassemble the synthesizer.

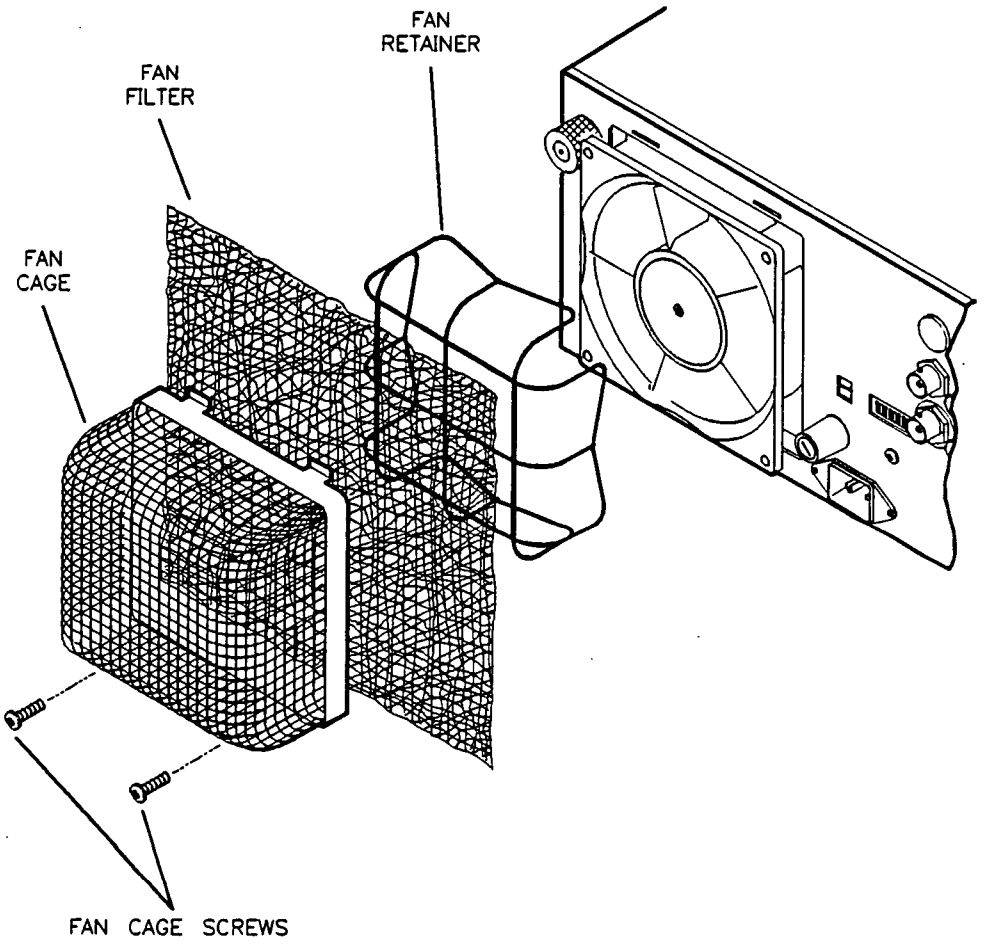


Figure 10-1. Removing the Fan Filter

How To Replace the Line Fuse

The line fuse is located on the instrument rear panel. Replace this fuse as follows:

1. Turn the synthesizer to standby (yellow LED on).
2. Remove the AC line cord.
3. Refer to Figure 10-2. Using a small flat–blade screwdriver, rotate the fuse cap counterclockwise, and remove the fuse holder.
4. Replace the original fuse.
5. Replace the fuse holder in the rear panel. Using the screwdriver, rotate the fuse cap clockwise to secure the fuse holder in place.
6. Reconnect the synthesizer to line power.

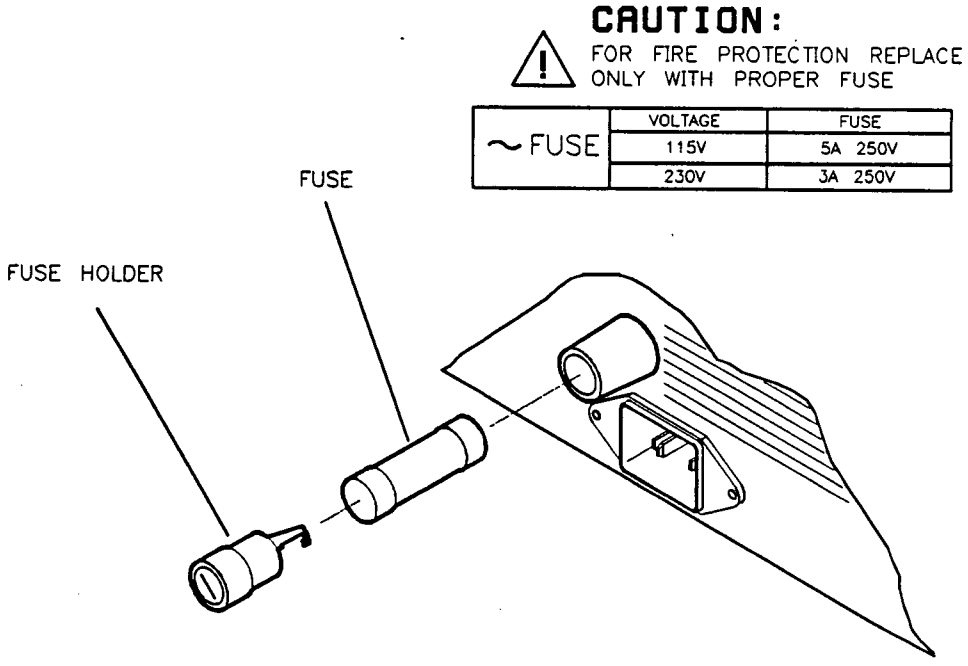


Figure 10-2. Replacing the Line Fuse

Connector Care

Clean and gage the synthesizer's output connector periodically. For details, refer to *Application Note 326*, which documents the principles of microwave connector care.

How to Replace the Battery

Caution The A15 assembly contains static-sensitive components. Use a static-safe workstation and wear a grounding strap. Always handle a printed circuit board by the edges.

1. Turn the synthesizer to standby (yellow LED on).
2. Remove the A15 CPU assembly.
3. Remove the old battery (Figure 10-3) and dispose of it properly (see previous warning).
4. Check the new battery before installing it:
   a. Place a 10 kΩ resistor across the battery.
   b. Measure the voltage across the resistor.
   c. If the measured voltage is $\geq$ 3.4V (typically 3.6V), continue with this procedure. If not, dispose of the battery. Repeat from step 4a with a new battery.
5. Install the new battery on the CPU assembly.
6. Reinstall the CPU assembly in the synthesizer.
7. Turn on the instrument (green LED on).
8. Verify that A15TP1 (I BATT) is less than 3 mV. A larger voltage indicates excessive battery drain.

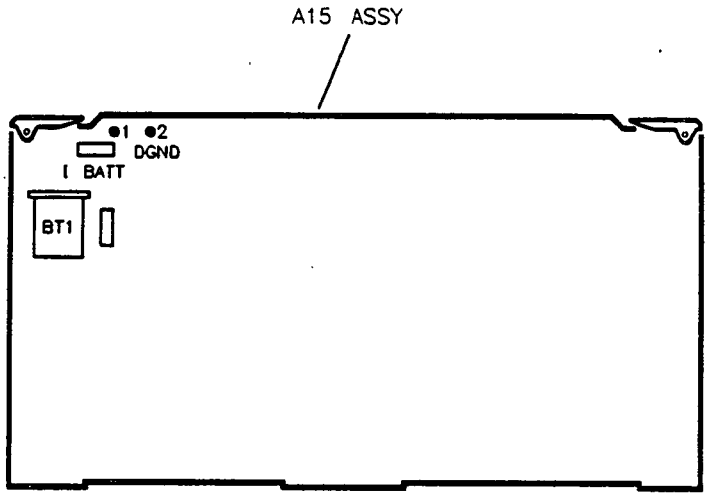


Figure 10-3. Instrument Battery (A15BT1) Location

Connector Care

Clean and gage the synthesizer's output connector periodically. For details, refer to *Application Note 326*, which documents the principles of microwave connector care.

HEWLETT PACKARD

Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER _____

over

HEWLETT PACKARD

Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

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ADDRESS

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MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER _____

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER _____

over

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

_____

_____

_____

_____

_____

_____

_____

If unit is part of system list model number(s) of other interconnected instruments. _____

_____

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

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If unit is part of system list model number(s) of other interconnected instruments. _____

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9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

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If unit is part of system list model number(s) of other interconnected instruments. _____

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11

Specifications

Dedicated HP 8510 System Source Models

Dedicated sources are optimized for use as HP 8510 system components. They are configured without modulation capabilities or front panel keyboards/displays, and with rear panel connectors and one-year on-site service (where available). Specifications for these models are the HP 8510 system specifications, plus the following:

Frequency

Range

HP 83621A: 45 MHz to 20 GHz
HP 83631A: 45 MHz to 26.5 GHz
HP 83651A: 45 MHz to 50 GHz

Resolution: 1 Hz

Frequency Bands:

Band	Frequency Range	n
0	10 MHz to < 2.0 GHz	1
1	2.0 to < 7 GHz	1
2	7 to < 13.5 GHz	2
3	13.5 to 20 GHz	3
4	> 20 to < 26.5 GHz	4
5	≥ 26.5 to < 33.4 GHz	6
6	≥ 33.4 to < 38 GHz	6
7	≥ 38 to 50 GHz	8

Accuracy

CW Mode: Same as time base (Internal time base verified to 1 ppm with standard on-site verification procedure.)
Swept Mode (sweep times ≥ 100 ms and ≤ 5s):
  Upper Frequencies ≤ 26.5 GHz
    Sweep widths ≤ n x 10 MHz: 0.1% of sweep width ± time base accuracy
    Sweep widths > n x 10 MHz and ≤ 400 MHz: 1% of sweep width
    Sweep widths > 400 MHz and ≤ 4 GHz: 4 MHz
    Sweep widths > 4 GHz: 0.1% of sweep width
  Upper Frequencies > 26.5 GHz
    Sweep widths ≤ n x 10 MHz: 0.1% of sweep width ± time base accuracy
    Sweep widths > n x 10 MHz and ≤ 800 MHz: 1% of sweep width
    Sweep widths > 800 MHz and ≤ ≤8 GHz: 8 MHz
    Sweep widths > 8 GHz: 0.1% of sweep width

Output Power

Maximum Leveled

Frequencies ≤ 20 GHz: +10 dBm
Frequencies > 20 GHz and ≤ 26.5 GHz: +4 dBm
Frequencies > 26.5 GHz and ≤ 40 GHz: +3 dBm
Frequencies > 40 GHz: 0 dBm

Minimum Settable: −20 dBm

General

Environmental

Operating Temperature Range

0 to 55°C

EMC

Within limits of VDE 0871/6.78 Level B, FTA 1046/1984, and Mil Std-461B Part 7 RE02.

Warm-Up Time

Operation

Requires 30 minutes warm-up from cold start at 0 to 55°C. Internal temperature equilibrium reached after 2 hour warm-up at stable ambient temperature.

Frequency Reference

Reference time base is kept at operating temperature with the instrument connected to AC power. Instruments disconnected from AC power for more than 24 hours require 30 days to achieve time base aging specification. Instruments disconnected from AC power for less than 24 hours require 24 hours to achieve time base aging specification.

Power Requirements

48 to 66 Hz; 115 volts (+10/−25%) or 230 volts (+10/−15%); 400 VA maximum (30 VA in STANDBY).

Weight and Dimensions

Net Weight: 27 kg (60 lb)
Shipping Weight: 36 kg (80 lb)
Dimensions: 178 H x 425 W x 648 mm D (7.0 x 16.75 x 25.5 inches)

Inputs and Outputs

RF Output

Nominal output impedance 50 ohms. (Precision 2.4 mm male connector, rear panel – HP 83651A; Precision 3.5 mm male connector, rear panel – HP 83621A/31A).

External ALC Input

Nominal input impedance 100 kohms. Used for negative external detector or power meter leveling. (BNC female connector, rear panel.)

Trigger Input

Activated on a TTL rising edge. Used to externally initiate an analog sweep or to advance to the next point in step or list mode. (BNC female connector, rear panel.)

Trigger Output

Outputs a one microsecond-wide TTL-level pulse at 1601 points evenly spaced across an analog sweep, or at each point in step or list mode. (BNC female connector, rear panel.)

10 MHz Reference Input

Accepts 10 MHz ±100 Hz, 0 to +10 dBm reference signal for operation from external time base. Nominal input impedance 50 ohms. (BNC female connector, rear panel.)

10 MHz Reference Output

Nominal signal level 0 dBm, nominal output impedance 50 ohms. (BNC female connector, rear panel.)

Sweep Output

Supplies a voltage proportional to the sweep ranging from 0 volts at start of sweep to +10 volts at end of sweep, regardless of sweep width. In CW mode, voltage is proportional to percentage of full instrument frequency range. Minimum load impedance 3 kohms. Accuracy ±0.25%, ±10 mV, typical. (BNC female connector, rear panel.)

Stop Sweep Input/Output

Sweep will stop when grounded externally. TTL-high while sweeping, TTL-low when HP 8360 stops sweeping. (BNC female connector, rear panel.)

Z-Axis Blanking/Markers Output

Supplies positive rectangular pulse (approximately +5 volts into 2 kohms) during the retrace and bandswitch points of the RF output. Also supplies a negative pulse (−5 volts) when the RF is at a marker frequency (intensity markers only). (BNC female connector, rear panel.)

Volts/GHz Output

Supplies voltage proportional to output frequency at 0.5 volts/GHz (internally switchable to 0.25 or 1 volt/GHz). Maximum output 18 volts. Minimum load impedance 2 kohms. Accuracy ±0.5%, ±10 mV, typical. (BNC female connector, rear panel.)

Source Module Interface

Provides bias, flatness correction, and leveling connections to HP 83550-series millimeter-wave Source Modules. (Special, front and rear panels.)

Auxiliary Interface

Provides control signal connections to HP 8516A S-parameter Test Set. (25-pin D-subminiature receptacle, rear panel.)

12

Installation

Introduction

This chapter provides installation instructions for the HP 83621A/31A/51A synthesized sweepers in an HP 8510 system. It also provides information about initial inspection, damage claims, preparation for use, packaging, storage, and shipment. Installation of all three models is the same unless otherwise noted.

Refer to the installation chapter in the HP 8510 documentation for overall system installation and preinstallation requirements for the HP 8510 system.

Initial Inspection

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, keep it until the contents of the shipment have been checked for completeness and the synthesizer has been checked mechanically and electrically. The contents of the shipment should agree with the items noted on the packing slip. Refer to "Performance Tests" in this manual for electrical performance procedures.

If there are any electrical or mechanical defects, or if the shipment is incomplete, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or if the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping material for the carrier's inspection. The HP office will arrange for repair or replacement without waiting for a claim settlement.

Preparation for Use

Power Requirements

The synthesizers require a power source of 115V (+10/−25%) or 230V (+10/−15%), 48 to 66 Hz, single-phase. Power consumption is 400 VA maximum (30 VA in standby).

Line Voltage and Fuse Selection

The synthesizer is provided with a voltage selector (located on the rear panel) to match the synthesizer to the AC line voltage. Both the line selector and fuse were selected at the factory to match the AC line voltage expected to be found at the shipping destination.

Caution 

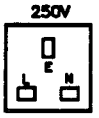
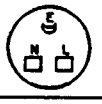
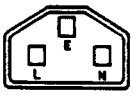
To prevent damage to the instrument, verify that the voltage selector is set to match the AC line voltage *before* applying power to the instrument.

Refer to the "Preventive Maintenance" chapter in this manual for information on changing fuses.

Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument chassis. Figure 12-1 shows the styles of plugs available on power cables supplied with Hewlett-Packard instruments. The HP part numbers indicated are part numbers for the complete power cable/plug set. The specific type of power cable/plug shipped with the instrument depends upon the country of shipment destination.

The offset prong of the three-prong connector is the grounding pin. The protective grounding feature is preserved when operating the synthesizer from a two contact outlet by using a three-prong to a two-prong adapter and connecting the green wire of the adapter to ground. An adapter is available (HP part number 1251-0048) for US connectors only.

PLUG TYPE [1]	CABLE HP PART NUMBER [2]	PLUG DESCRIPTION [2]	CABLE LENGTH (inches)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	Straight ZNSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	Straight CEE7-VII 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, Republic of So. Africa, India (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	Straight NEMA5-15P 90° Straight NEMA5-15P Straight NEMA5-15P 90° Straight NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan, (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	Straight SEV1011.1959 24507, Type 12	79	Gray	Switzerland
250V 	8120-0698	Straight NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	Straight DHCK 107 90°	79 79	Gray Gray	Denmark
250V 	8120-1860	Straight CEE22-VI (System Cabinet Use)			

1. E = Earth Ground; L = Line; N = Neutral.
2. Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.

Figure 12-1. AC Power Cables Available

Recalibrating the YIG Oscillator

The following internal automated procedure must be performed prior to using the synthesizer in an HP 8510 system. This procedure internally recalibrates the synthesizer to compensate for any magnetic field changes or performance differences of the YIG sphere incurred during shipment. The YIG sphere used with the synthesizers is sensitive to shock and to magnetic variances caused by the following:

- Magnetic fields in proximity to the instrument.
- A change in the earth's magnetic field.

Procedure:

1. Set up the equipment required to run the front panel emulation software supplied with this manual. See "Utilities" in the "Automated Tests" chapter for specific information about requirements for running this software.
2. Connect the RF output of the synthesizer through a cable to the RF input of the test set used in the HP 8510 system. Do not connect any other cables between the HP 8510 system and the synthesizer at this time.
3. When the front panel emulator program is running, on the synthesizer set:

   (PRESET) (USER CAL) `Tracking Menu` `Auto Track`

   The auto track automated procedure will recalibrate the YIG oscillator.
4. Disconnect the HP-IB cable from the controller and continue with this chapter.

Language and HP-IB Address Selection

The synthesizers use one of the following external interface languages: TMSL (Test and Measurement System Language) and Analyzer Language. Operation in an HP 8510 system requires that the synthesizer be set to Analyzer Language.

The language configuration and the synthesizer HP-IB address are both set with a switch located on the rear panel of the synthesizer. The factory default setting for this switch is Analyzer Language at an HP-IB address of 19. This is the setting normally used with HP 8510 system sources.

Check the rear panel switch Figure 12-2 to make sure that Analyzer Language and HP-IB address 19 have been set.

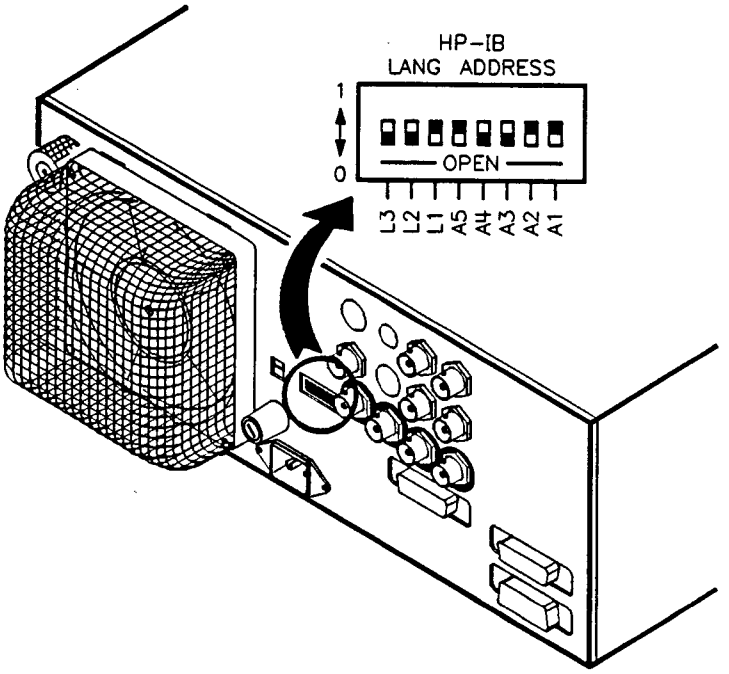


Figure 12-2. Rear Panel HP-IB Switch

TMSL is not used as the language for controlling the source in an HP 8510 system. Therefore, an explanation of that language is not included here. Order the *User's Handbook*, (see "Replaceable Parts") for a complete explanation of TMSL, which also includes equivalent Analyzer Language programming codes.

HP 8510 System Firmware Requirements

All HP 8510 systems must have firmware revision 4.0 or greater for compatibility with the HP 83621A/31A/51A synthesizers. Revision 6.0 or greater is required to implement all capabilities (such as Quick Step). Performance upgrade packages are available to upgrade the firmware on HP 8510 network analyzers. Contact your local Hewlett-Packard Sales and Support office.

HP 8510 System Cable Connections

Cable connections between the HP 8360 series synthesizers and any HP 8510 having a firmware revision *less than* 6.0 are identical to those using the HP 8340/8341 synthesizer. Figure 12-3 shows the cabling connections of a typical HP 8510B system using an HP 8360 series synthesizer as the source. Figure 12-4 shows the cabling connections of a typical HP 8510C system using an HP 8360 series synthesizer as the source.

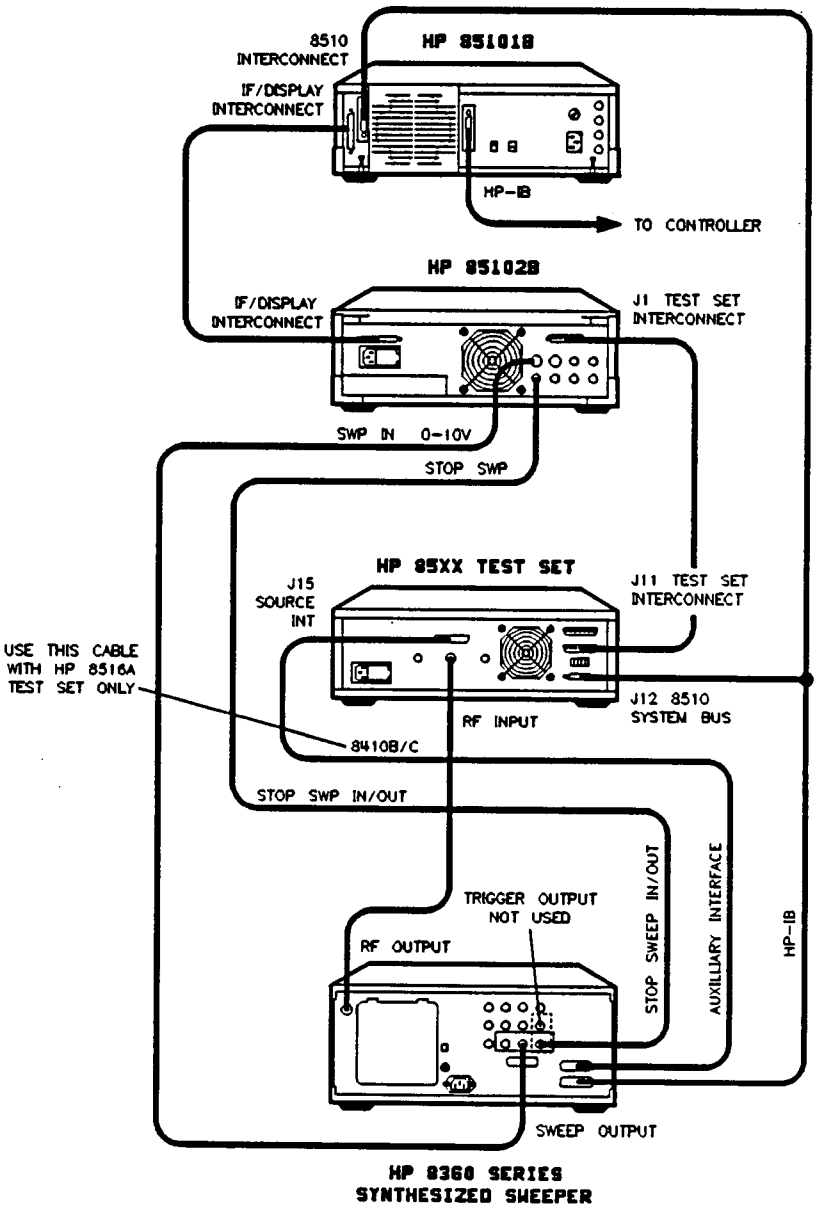


Figure 12-3. HP 8510B/8360 Series Cabling Diagram

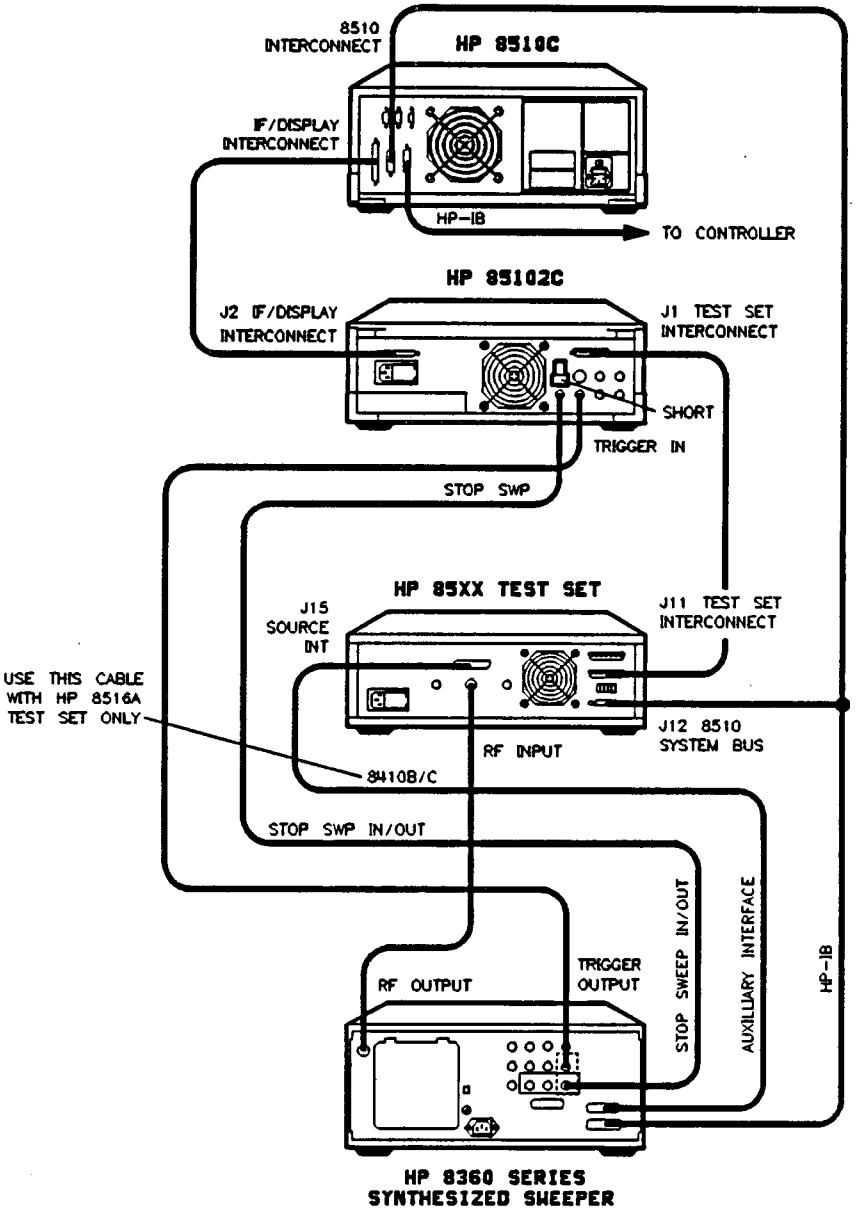


Figure 12-4. HP 8510C/8360 Series Cabling Diagram

10 MHz Frequency Reference Selection and Warm-up Time

To keep the internal timebase frequency reference oven at operating temperature, the synthesizer must be connected to AC line power. The synthesizer requires up to 30 minutes to warm up from a cold start before the crystal oscillator temperature has stabilized. With a stable outside temperature, internal temperature equilibrium is reached after approximately two hours. For additional information on warm-up times, see "Specifications" in this manual.

Operating Environment

Temperature. The synthesizer may be operated in environments with temperatures from 0 to +55°C.

Humidity. The synthesizer may be operated in environments with humidity from 5 to 80% relative at +25 to 40°C. However, protect the synthesizer from temperature extremes, which can cause condensation within the instrument.

Altitude. The synthesizer may be operated at pressure altitudes up to 4572 meters (approximately 15,000 feet).

Cooling. The synthesizer obtains all cooling air flow by forced ventilation from the fan mounted on the rear panel. Information on cleaning the fan filter is located in the "Preventive Maintenance" chapter.

Caution



Ensure that all air flow passages at the rear and sides of the synthesizer are clear *before* installing the instrument in its operating environment. This is especially important in a rack mount configuration.

Chassis Kits

Rack Mount Slide Kit (Option 806)

Option 806 synthesizers are supplied with rack mount slides and the necessary hardware to install them on the synthesizer. The following table itemizes the parts in this kit.

Table 12-1. Rack Mount Slide Kit

Quantity	Description
Rack Mount Kit (Includes the following parts)	
2	Rack Mount Flanges
8	Screws
Slide Kit (Includes the following parts)	
2	Slide Assemblies
4	Screws (Inner Slide Assembly)
8	Screws (Outer Slide Assembly)
8	Nuts (Outer Slide Assembly)
Slide Adapter Kit (*Non-HP*, includes the following parts)	
4	Adapter Brackets
4	Adapter Bar
8	Screws (Bracket to Bar)
8	Nuts (Bracket to Slide Assembly)

Installation Procedure

1. Refer to Figure 12-5. Remove the handle trim strips.
2. Remove four screws per side.
3. Using the screws provided, attach the rack mount flanges to the outside of the handles.
4. Remove the side straps and end caps.
5. Remove the bottom and back feet and the tilt stands.

6. Refer to Figure 12-6. Remove the inner slide assemblies from the outer slide assemblies.
7. To secure the side covers in place, mount the inner slide assemblies to the instrument with the screws provided.
8. With the appropriate hardware, install the outer slide assemblies to the system enclosure.
9. Lift the synthesizer into position. Align the inner and outer slide assemblies and slide the instrument into the rack. Realign the hardware as needed for smooth operation.

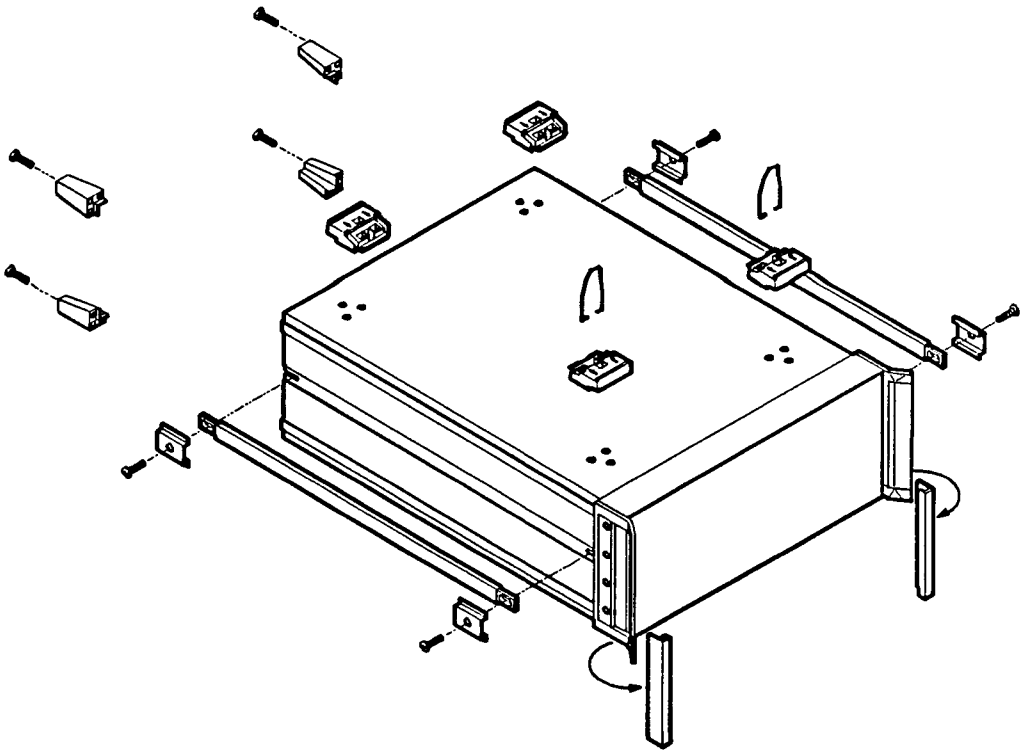


Figure 12-5. Removing the Side Straps and Feet

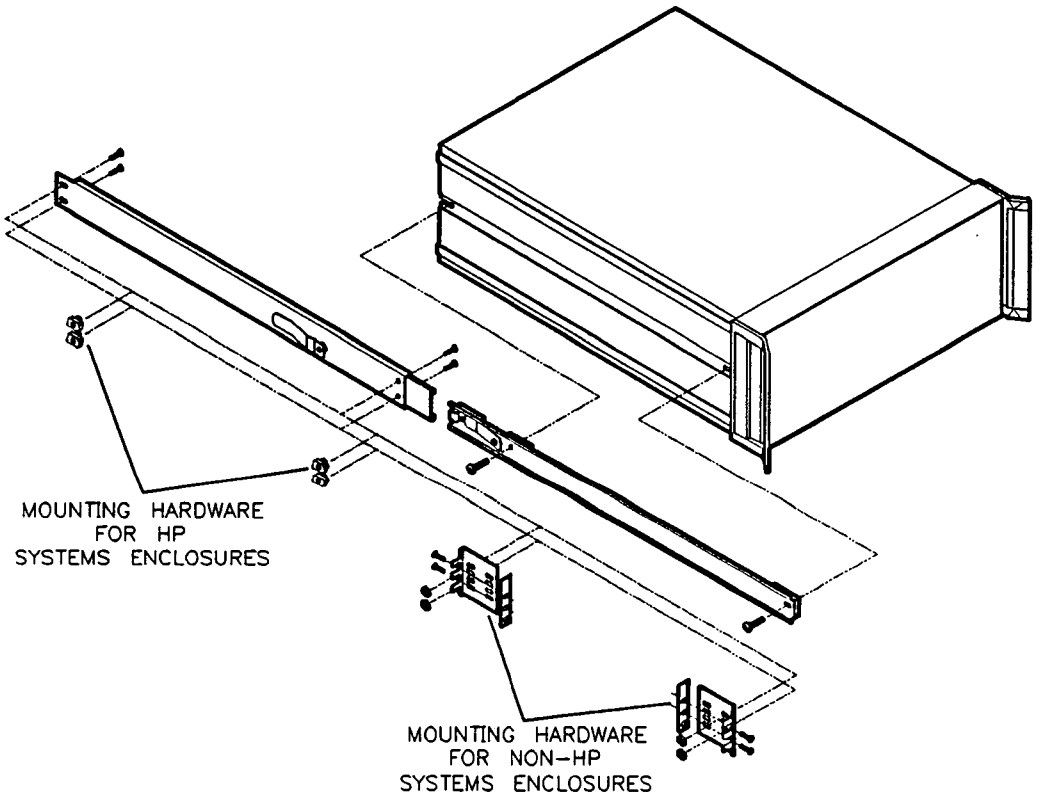


Figure 12-6. Chassis Slide Kit

Rack Flange Kit for Synthesizers with Handles Removed (Option 908)

Option 908 synthesizers are supplied with rack flanges and the necessary hardware to install them on the synthesizer after removing the instrument handles. The following table itemizes the parts in this kit.

Table 12-2.
Rack Flange Kit for Synthesizers with Handles Removed

Quantity	Description
2	Rack Mount Flanges
8	Screws

Installation Procedure

1. Refer to Figure 12-7. Remove the handle trim strips.
2. Remove the four screws on each side that attach the handles to the instrument; remove the handles.
3. Using the screws provided, attach the rack mount flanges to the synthesizer.
4. Remove the bottom and back feet and the tilt stands before rack mounting the instrument.

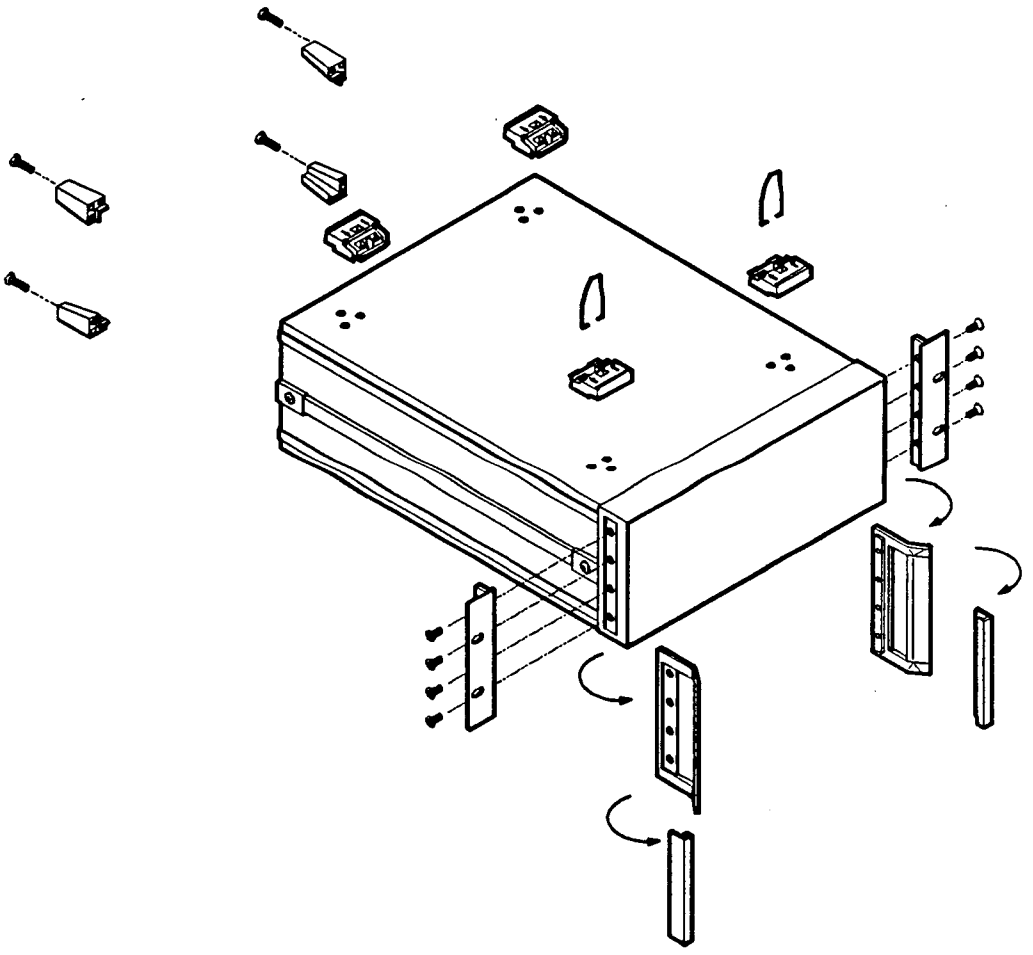


Figure 12-7. Rack Mount Flanges for Synthesizers with Handles Removed

Rack Flange Kit for Synthesizers with Handles Attached (Option 913)

Option 913 synthesizers are supplied with rack flanges and the necessary hardware to install them on the synthesizer without removing the instrument handles. The following table itemizes the parts in this kit.

Table 12-3.
Rack Flange Kit for Synthesizers with Handles Attached

Quantity	Description
2	Rack Mount Flanges
8	Screws

Installation Procedure

1. Refer to Figure 12-8. Remove the handle trim strips.
2. Remove the four screws on each side that attach the handles to the instrument.
3. Using the longer screws provided, attach the rack mount flanges to the outside of the handles.
4. Remove the bottom and back feet and the tilt stands before rack mounting the instrument.

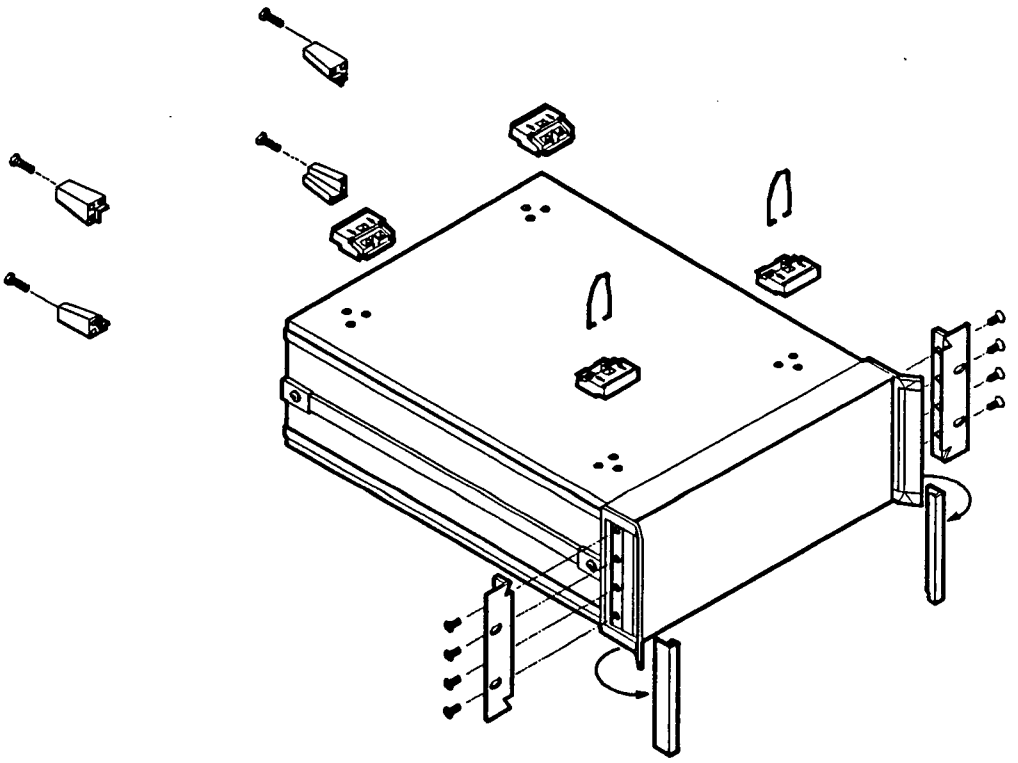


Figure 12-8. Rack Mount Flanges for Synthesizers with Handles Attached

13

Instrument History

Introduction

This manual documents the current production versions of the HP 83621A/31A/51A instruments. All HP 83621A/31A synthesized sweepers with serial prefix numbers *lower* than 3103A are documented in a previous manual set. Order either 83621-90007 or 83631-90007.

As future versions of the HP 83621A/31A/51A are developed, this manual will be modified to apply to those instruments. Information provided in this chapter will then allow you to adapt this manual to the earlier versions.

Since there are no earlier versions at this time (other than those already documented in another manual set), there is no information provided in this chapter yet.

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